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ABSTRACT

The report details development and implementation of a project to use the visual response system (VRS) to aid the mainstreaming of mildly handicapped students. The VRS uses overhead projectors, individual earphones, and other hardware at each student's desk so that students can respond to teacher presentations. The advantages are listed for the VRS environment in programed learning. The report details the design, construction and maintenance of the VRS. The next section reviews research using the VRS to teach the learning disabled, emotionally disturbed, and educable mentally retarded composition, punctuation, spelling, mathematics (fractions), science (photosynthesis), self management, and student-student interaction. The VRS was found to be an effective learning environment for small groups of mildly handicapped students. Project inservice training and dissemination activities are detailed. Extensive appendixes include VRS materials for the lessons and for inservice teacher training. (CL)

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# VISUAL RESPONSE SYSTEM

## DEMONSTRATION PROJECT

## FINAL REPORT

EC 132412

This final report was prepared under a grant (No. G007703334) from the Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education and Welfare. Persons undertaking such projects under government sponsorship are encouraged to express their judgment freely in professional and technical matters. Therefore, points of view or opinions expressed herein, do not necessarily represent official Office of Education position or policy.

# FINAL REPORT

## VISUAL RESPONSE SYSTEM DEMONSTRATION PROJECT

Submitted to:

Bureau of Education for the Handicapped
USOE/HEW

By:

The Ohio State University Research Foundation

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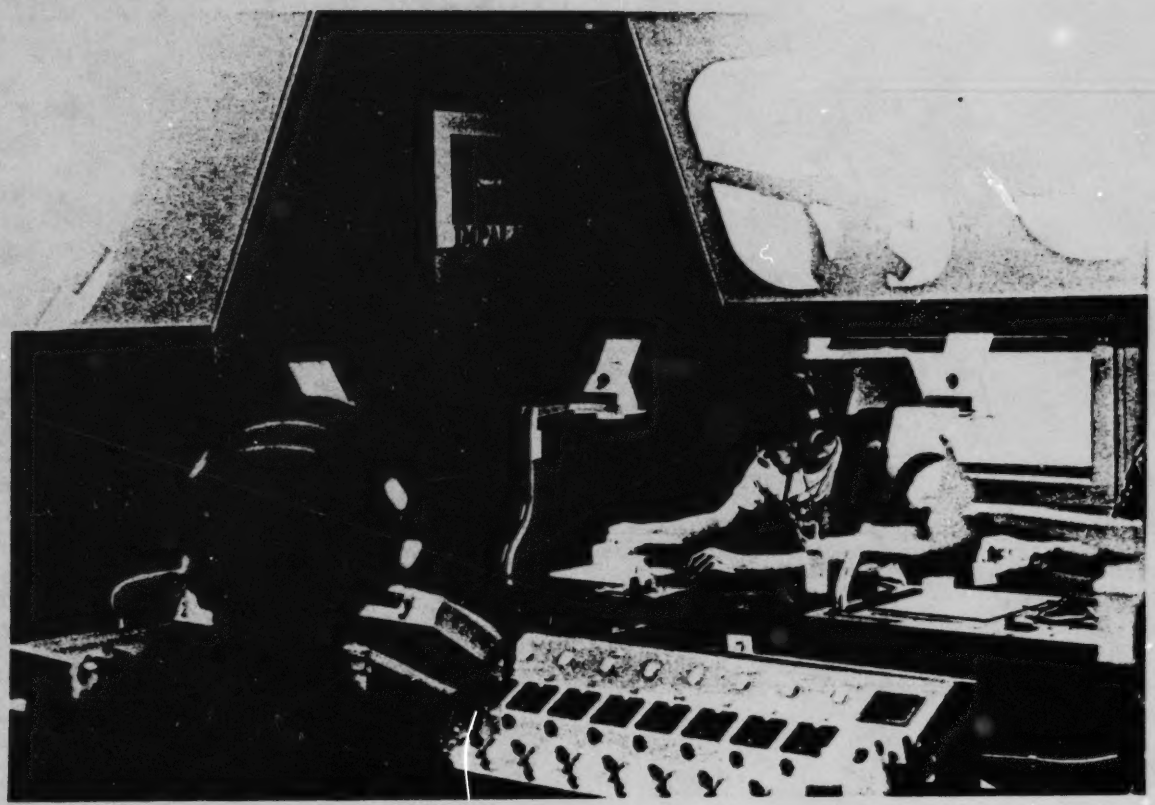

Visual Response System

Buckeye Youth Center, Columbus, Ohio

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# I. INTRODUCTION

Providing an appropriate education to mildly handicapped students in the least restrictive alternative means that many children, who previously spent the entire school day in a special class, are being integrated into regular classrooms. Efforts to mainstream mildly handicapped children in regular classrooms are often unsuccessful because of one or more of at least five important reasons (Heward, in press). First, in large group instruction it is difficult to provide enough learning trials for every student. Children in most classrooms make relatively few academic responses when one considers the number of hours they spend in school. Students simply do not get enough opportunities to learn (Hall, Delquadi, and Harris, 1971). To make matters worse, observation in the regular classroom has shown that in many cases the mildly handicapped student receives even fewer opportunities to respond than his non-handicapped peers (Bryan, 1974).

Second, when a teacher is responsible for the instructional management of a large group of students, individualized instruction, thought desirable, may be extremely difficult to implement. It is seldom possible for the regular classroom teacher to arrange events so that mainstreamed students can receive stimuli and make responses in modes tailored for their individual needs. Too often, "individualized instruction" means that students work on seatwork at their own desk.

Third, when mildly handicapped students are integrated into regular classrooms, many teachers do not interact with these children often enough nor positively enough to affect desired educational outcomes (Bryan, 1974). Appropriate teacher-student interaction is a necessary ingredient for academic and social growth, but it is sometimes withheld from the mildly handicapped student.

Fourth, because the mainstreamed mildly handicapped child is often given special instruction in a resource room or a tutoring situation, he has reduced opportunities to observe and imitate appropriate academic and social behaviors of peer models.

Fifth, while tutoring and resource room programs have been successful in generating satisfactory, and many times impressive, academic growth rates by mildly handicapped students, little data are available to demonstrate generalization of skills acquired in the special instructional settings to the regular classroom (Glavin, Quay, Annesley, and Werry, 1971). Generalization is a technological problem. Generalization of acquired skills across stimulus settings is neither an automatic by-product of teaching, nor a mystical "extra" which sometimes appears and sometimes doesn't (Stokes and Baer, 1977). When the variables which affect

generalization are analyzed, it is not surprising that the mildly handicapped child emits few responses in the regular classroom that were acquired during special instruction.

Given these problems, a need exists to provide an environment in which mildly handicapped children can: (1) engage in many programmed learning trials per unit of time; (2) have instruction delivered in an individualized manner; (3) receive an increased amount of teacher feedback and interaction; (4) observe the appropriate academic and social behavior of non-handicapped peers; and (5) acquire skills in a manner which would enhance generalization to other settings.

This project sought to demonstrate and evaluate the effectiveness of the Visual Response System in fulfilling the needs cited above.

## Visual Response System--an Environment for Small Group Interaction

In 1967, the Visual Response System (VRS) was created by Dr. Raymond Wyman as a means to raise the level of activity and teacher-student interaction in classrooms for the deaf (Wyman, 1968, 1969a, b). Two very powerful and positive instructional features of the Visual Response System are: (1) opportunity for student response is maximized, i.e., every student responds to every question, problem or situation as opposed to only when called upon as in the regular classroom; and (2) visual access to student responses as they are emitted enables a teacher to deliver reinforcement and/or remediation in a direct, continuous, and virtually immediate fashion (Heward, 1974a, 1978a, b).

The Visual Response System is a classroom where each student's desk has an attached or built-in overhead projector. Students respond on their overhead projectors to a series of teacher presentations. The teacher also has an overhead projector and possibly other hardware, such as a slide projector, filmstrip projector, and/or tape recorder with which to present instructional stimuli for student response. In addition, an integrated sound system with individual student headphones enables the teacher to deliver auditory stimuli in a controlled manner.

There is no particular way that a Visual Response System must be constructed. The most common arrangement is to align the student overhead projectors in a horseshoe shaped configuration with the teacher's overhead projector at the open end. The projectors may be focused on screens or the classroom walls behind them. The horseshoe shape seems most advantageous because the teacher can rapidly scan all of the students' projected responses. Also, student-student interaction, if desired, can be facilitated in the horseshoe shaped configuration. See Fig. 1 (p. 3) for a floor plan of the project's Visual Response System, which is located at The Buckeye Youth Center in Columbus, Ohio.

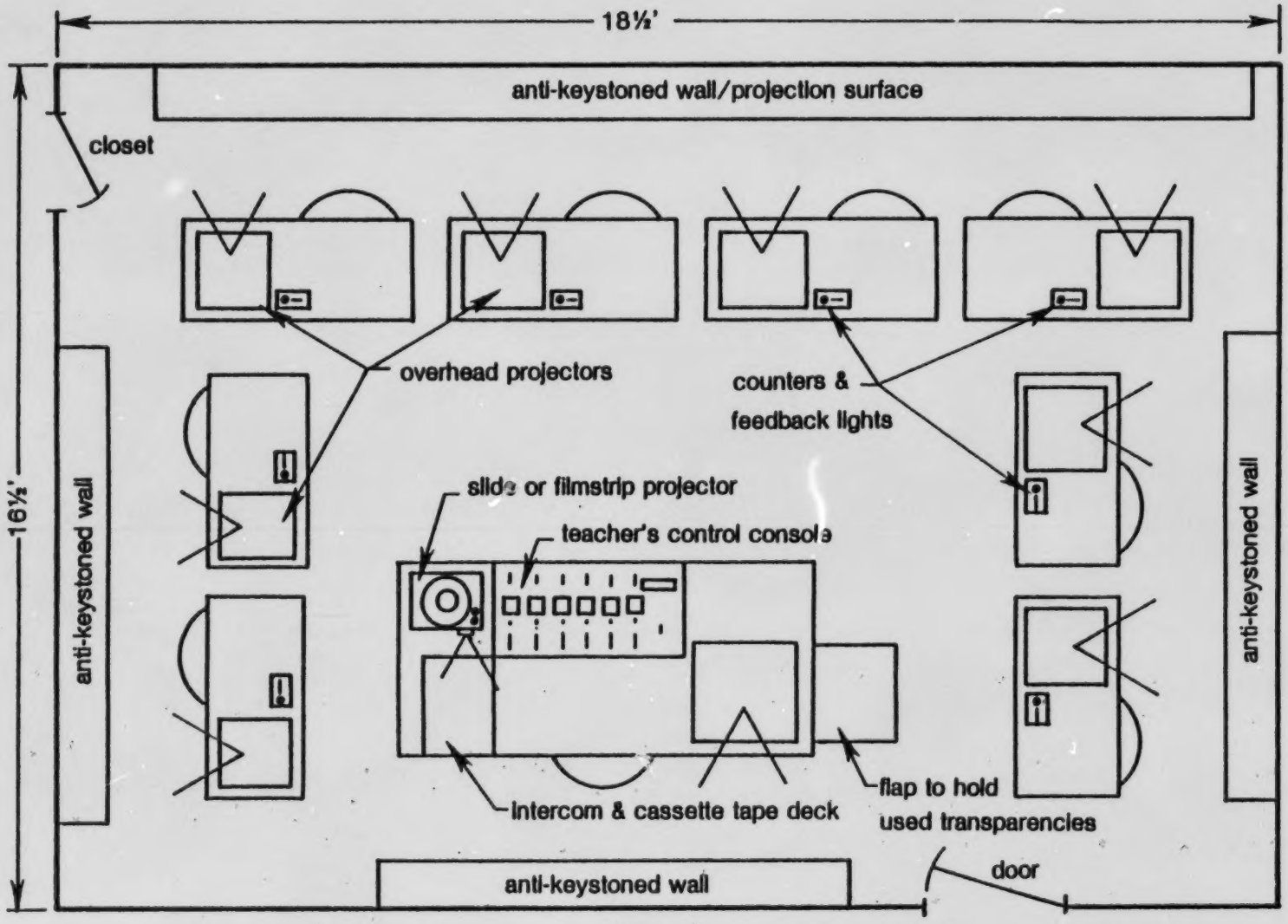



Fig. 1 - Floorplan of the Buckeye Youth Center Visual Response System

Heward (1978a) described 11 aspects of the Visual Response System relative to instructional management:

1. Active student response is generated. All students respond to all stimulus materials. There is no taking turns in the Visual Response System. Every student can respond to every question, problem, situation, etc., as opposed to once in every eight or ten times in a traditional classroom setting. In the typical classroom or small group instructional setting, a student responds only when called on by the teacher, and his/her classmates follow along or mark time until they are called upon to respond. A teacher can only make assumptions about how much they have benefited from another students' learning trial. Passive students are not learners, but merely bystanders to the educational process. The technology provided by the Visual Response System enables (requires) each student in the group to make a response to every question or problem posed by the teacher. When a math problem is projected each student has the opportunity to solve it.

2. All student responses can be directly observed. Students respond on their overhead projectors. Those responses are projected on a screen or wall behind the student allowing the teacher to directly observe and monitor all of the student's responses. If a group of students is writing sentences describing a projected scene, their teacher can directly observe and note specific aspects of each student's writing behavior which requires remediation. Watching the precise movements students make as they attempt to solve arithmetic problems allows a teacher to pinpoint which operations are troublesome for each student.

3. Many types of behavior can be defined, observed, measured, and consequated. Thirty responses that can be produced on, and projected by the overhead projector have been identified. It is probable that more will be discovered. Table 1 shows the wide range of response topographies which are compatible with an overhead projector.

4. Opportunity exists for multi-modality learning. In one sense, naming this technology a Visual Response System is a misnomer. Students can receive stimuli visually (projected images), auditorially (integrated sound system), tactually (manipulating objects on the overhead projector), or in any combination of those three modes. Likewise, responses can be made rotorically and/or orally. One might just as well name this classroom a multimodality learning laboratory.

5. Reinforcement can be delivered immediately. The teacher can immediately deliver positive feedback for correct responses since each student's response can be observed. A stopwatch was

Table 1. Some Student Behaviors Which can be Specified, Observed, and Measured in the Visual Response System

1. Write Sentence
2. Spell a Word
3. Place a Symbol
4. Solve a Math Problem
5. Point
6. Underline
7. Circle
8. Match
9. Oppose
10. Map
11. Chart
12. Restate
13. Arrange Letters/Numbers
14. Complete
15. Fill-in
16. Copy
17. Diagram
18. Graph
19. Color
20. Disclose
21. Cover
22. Compose
23. Make a Time Line
24. Synthesize
25. Draw
26. Categorize
27. Dissect
28. Trace
29. Construct
30. Compare

employed to measure the amount of time which elapsed between a student's emission of a correct response and delivery of reinforcement. In a group of eight students, who were writing sentences describing a projected picture, the average reinforcement delay (measured from the moment a student placed a period at the end of a correct sentence until a green light flashed and a point was registered on a counter at the student's desk) was about four seconds (Heward and Eachus, in press). Seldom did a student write a correct sentence and not be reinforced within seven or eight seconds; with many points being delivered virtually simultaneously with the student placing a period at the end of a correct sentence. The relative immediacy of this kind of feedback compares favorably with a situation where students perform academic responses and receive feedback in the form of a graded paper the next day. Of course, the amount of reinforcement delay in the Visual Response System will vary with the responses students are making (e.g., in a sentence writing situation students are completing individual responses at different times and a teacher soon becomes adept at scanning the projected responses and delivering reinforcers immediately), but the unit of time one can use to measure the delay will always be seconds as opposed to minutes, hours, or days.

6. Many types of reinforcers can be used. The use of salient rewards for students is important in teaching. With exceptional children, it is critical. The technology provided by the Visual Response System enables the teacher to deliver a wide range of reinforcers. Visual displays (e.g., cartoon figures projected on the teacher's overhead), hand-delivered tangibles, music and other auditory stimuli, and electrically delivered points are some of the reinforcers that can be employed in the Visual Response System.

7. Remediation can be immediate and performed in a non-punishing manner. Corrective feedback, when needed to help students change incorrect responses into correct ones, can be delivered in several ways which are constructive yet not punishing or embarrassing to a student. After a given set of responses has been made by students, a teacher may place the correct answers on the overhead projector to serve as a model. Or, students may use the responses of peers as models for correctness. Another way in which teachers can make remediation non-punishing and functional is to reinforce students with points for self-correcting their own responses.

8. Full interaction is encouraged among a group of students. Student-student interaction can become an integral part of the instructional process, since each student can see all of the responses made by other students (depending on the particular arrangement of the projectors). In an experiment where students received reinforcement for writing correct sentences which

contained prenominal adjectives, one effect of student-student interaction was noted informally (Heward and Eachus, in press). Students wrote sentences describing a projected illustration for two five-minute periods each day. A contingency was in effect which didn't give credit to a student if he or she copied another student's sentence. However, if during the first writing period of a given session, a student wrote a sentence containing a word which previously had not been used as a prenominal adjective, e.g., "The boy has on a purple shirt," the word "purple" would appear for the first time in the sentences of other students during the next writing trial.

9. Instruction can be individualized. The Visual Response System affords the teacher a number of ways in which to individualize instruction: (1) when a series of questions or problems is projected, students can proceed through the sequence at their own rate; (2) response requirements can be altered to fit the needs and the skill levels of individual students, even though they are responding to the same materials, (e.g., a particular lesson may require some students to write the word "red," while others may only have to match the projected color by placing a square of red acetate on their projectors); and (3) by dividing a transparency into parts, or by presenting information to the students on separate projectors, a teacher can have different groups of students responding to totally different material, either in content or level of difficulty.

10. Measurement and evaluation of student progress and instructional effectiveness can be a direct by-product of a lesson. When Visual Response System lessons are properly designed, the various responses made by students provide the teacher with the data necessary for objective monitoring of each student's educational progress. For example, if counters are used at each student's desk to reward points for correct responses and a teacher knows the total response opportunities in a given session, he or she simply needs to record the point total for each student in order to measure responses correct.

11. Students enjoy the Visual Response System. Modern students are surrounded by technological hardware every day of their lives. The Visual Response System enables children to become "users" of technology rather than mere "observers." Students take pride in being able to operate "their" projectors. Teachers often note a lower degree of disruptive behavior in the Visual Response System as compared with a conventional classroom and some report higher "motivation" in students when in the special setting.

In summary, the Visual Response System is an environment which provides the basic requirements for the management of programmed instruction to small groups of students, while simultaneously providing the positive aspects of human interaction at all stages of that instruction.

## Literature Review

Since its conception, the Visual Response System has been installed and evaluated at several schools for the deaf, a hearing high school, and a state institution for juvenile offenders.

There have been a number of experimental assessments conducted to determine the effectiveness of the Visual Response System. The first was performed by Eachus (1971) at the American School for the Deaf. This study demonstrated that the rate, accuracy, and complexity of sentence writing by 10-12 year old deaf students could be modified by manipulation of the consequences for sentence writing via the Visual Response System. The Visual Response System allowed the teacher to award points immediately for correct sentences and to remediate incorrectly written responses. Points could be accumulated and traded in for items such as balloons, dolls, books, and model kits. The combination of reinforcement for correct sentences and remediation of incorrect responses doubled the number of correct sentences written per session, and increased accuracy from a baseline subject range of 27-63 to 90-100% correct. This increase in performance was evident in most subjects by the tenth session. A final phase of this experiment added a concurrent contingency for higher order sentence writing. In addition to the usual one point for grammatically correct sentences, two points were given for correct compound or complex sentences. Given immediate feedback on their writing behavior and student-student visual interaction made possible by the Visual Response System, the students began to write compound and complex sentences with increased accuracy for the remaining sessions of the experiment.

Piper (1970) replicated the Eachus experiment without utilizing a token economy system. In this experiment, conducted at the Tennessee School for the Deaf, social praise and teacher approval were used to reinforce composed question forms meeting criteria. Subjects in the experiment were nine year old deaf students described as under-achievers. When social praise was administered contingent on accurate question writing, a rapid increase in rate and accuracy was obtained.

The third experimental assessment of the Visual Response System (Barrette, 1971) was conducted in a high school with hearing students. A standard chemistry curriculum was presented to thirteen students, ages 15-17. Completion of workbook assignments was reinforced immediately by points which counted for the grade in the course. The structure of the Visual Response System in this study was a linear arrangement of all the student projectors. Thus, student-student interaction was not facilitated. This arrangement, however, did provide the chemistry teacher with immediate access to all student responses. Points were delivered by means of electrical counters. The class average was 62% accuracy during baseline conditions. During the two experimental phases when contingent reinforcement was available for correct student responses, the class averaged 94% and 98% correct for all items possible.

Gonzales (1971) studied the feasibility of using the Visual Response System with deaf pre-school children. Young deaf children often do not acquire the repertoire of behaviors that will enable them to function successfully in the school environment. Filmstrip material developed by Project LIFE (1963) and designed to teach pre-reading and pre-writing skills, was presented with a Visual Response System. A token economy was also utilized in this experiment. Discrimination and association responses concerning the color and shapes of various objects increased from an initial baseline level of 20-35% accuracy to more than 90% accuracy at the conclusion of the study.

Heward and Eachus (in press) conducted a systematic replication of the Eachus (1971) study at the Boston School for the Deaf to determine if the same basic procedures could generate new linguistic components in written language. Seven hearing impaired/aphasic students, 8-11 years old, served as subjects. After collecting baseline data on the subjects' sentence writing skills, a second phase of the study was introduced which made reinforcement contingent on writing grammatically and conceptually sound sentences. The results supported those found by Eachus (1971). That is, rate, performance, and accuracy increased. Subsequent experimental phases made more amounts of reinforcement available for writing sentences that included prenominal adjectives, adverbs, and then a final phase of prenominal adjectives plus adverbs. From writing virtually no sentences including modifiers, the subjects finished the study by producing 80-90% of their correct sentences with both linguistic components. Overall accuracy and rate remained high.

## Project Goals

The Visual Response System Demonstration Project was funded and implemented to carry out two major goals.

Goal No. 1.0 To design, develop, demonstrate, and evaluate a mediated environment which enables one teacher to manage simultaneously the instruction of a small group of mildly handicapped students.

Sub-Goal No. 1.1 To design and construct a mediated learning environment based on an existing technology called the Visual Response System.

Sub-Goal No. 1.2 To demonstrate and evaluate the Visual Response System in the delivery of reading, writing, spelling, and mathematics instruction to mildly handicapped students.

Sub-Goal No. 1.3 To disseminate instructional materials, techniques, and research and evaluation data which result from the demonstration.

Goal No. 2.0 To train inservice personnel in the effective use of the Visual Response System as an instructional environment for mildly handicapped students.

Sub-Goal No. 2.1 To determine and operationalize competencies necessary for teaching in the Visual Response System.

Sub-Goal No. 2.2 To conduct training sessions for inservice personnel on the effective use of the Visual Response System for academic instruction.

Sub-Goal No. 2.3 To disseminate teacher training materials and techniques generated by the project.

The remainder of this final report describes project activities carried out to fulfill these goals and the results of those efforts.

## II. DESIGN, CONSTRUCTION, AND MAINTENANCE OF THE VISUAL RESPONSE SYSTEM

To fulfill the requirements of project Goal No. 1.0, a Visual Response System (VRS) was designed and constructed at The Buckeye Youth Center, 2280 West Broad Street, Columbus, Ohio. This section of the final report describes the design and construction of the VRS, a breakdown of construction costs, and a report on maintenance costs.

### Design/Construction

The initial task in designing the Visual Response System was to select a room at Buckeye Youth Center. Room selection was based upon availability, accessibility (proximity to other classrooms), and size. To aid in the selection process Dr. Raymond Wyman, originator of the Visual Response System, was consulted and the final room selection was made. The room selected is centrally located in the school and easily accessible from all classrooms. Room size necessitated the construction of an eight student-station Visual Response System (see Fig. 1).

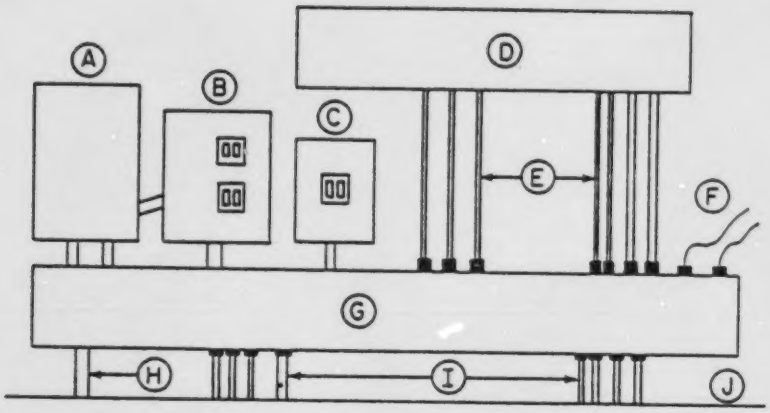
The construction of the room entailed four major areas: (1) electrical wiring; (2) room alterations; (3) student overhead projectors and desks; and (4) electronic monitoring system.

### Electrical Wiring

Before any work could be started in the room, electrical power had to be supplied. This involved running 60 amp/110 volt service into the room from a central power source. This circuit feeds a contactor located under the teacher's desk. From the contactor, power is supplied to all necessary points within the room (see Figs. 2 and 3). This allows the teacher to control all student overhead projectors through the master and individual student projector power switches located on the teacher's control console (see Fig. 4). Conduit was laid from the contactor to specific points (where the student desks were to be installed), attached to the floor, and terminated 3" above the floor. No interior room wiring was done at this point. All electrical wiring was supplied by an in-house electrician regularly employed by The Buckeye Youth Center.

### Room Alterations

A false floor consisting of 2 x 4's laid on their sides and 5/8" plywood was built to cover the electrical conduit. This false floor was




A. Contactor - 7½" x 12½" x 3½"

B. Junction box - 7½" x 11½" x 3½"

C. Junction box - 5" x 8" x 3½"

D. Teacher's control console (see Figure 4)

E. Conduit to teacher's control console

F. Wire to sound system

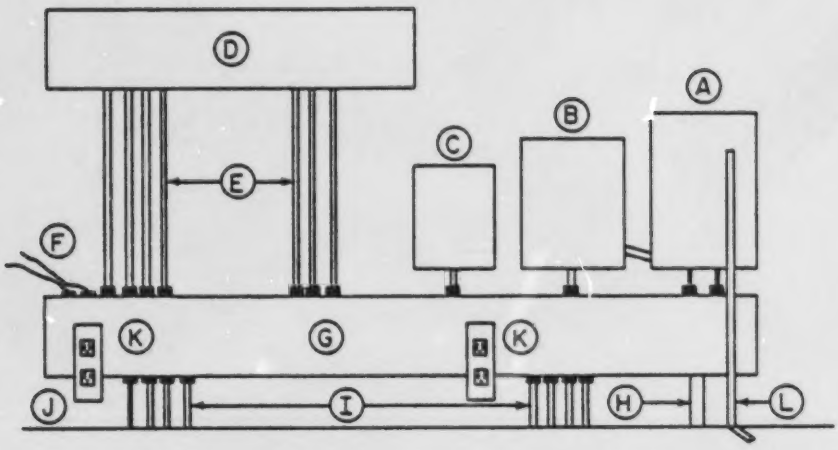
G. Metal trough 48" x 4½" x 4½"

H. Conduit with 60 amp/110 volt service

I. Conduit to student desks

J. Floor

Fig. 2 - Front view (facing students) of Visual Response System electrical equipment located under teacher's desk

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E. Conduit to teacher's control console

F. Wire to sound system

G. Metal trough - 48" x 4½" x 4½"

H. Conduit providing 60 amp/110 volt service

I. Conduit to student desks

J. Floor

K. Duplex outlets

L. Metal brace

Fig. 3 - Back view (facing teacher) of Visual Response System electrical equipment located under teacher's desk

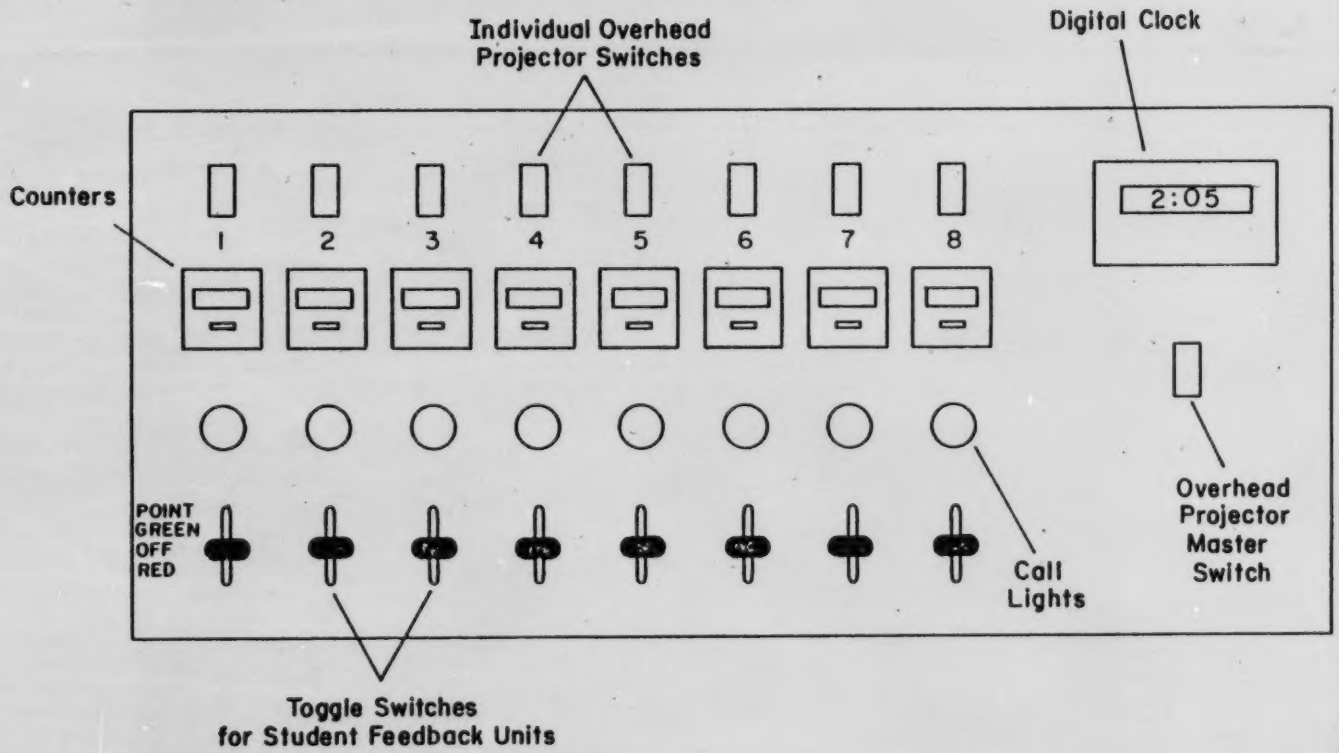




Fig. 4 - Visual Response System teacher's control console

2-1/4" high and left the ends of the conduit exposed for attachment to the student desks. The false floor was then carpeted. Carpeting served two purposes: (1) to muffle the noise in the room; and (2) to enhance the attractiveness of the room.

A teacher's desk (see Fig. 5[1]) was specially constructed for the Visual Response System. The desk housed the teacher's console, sound system (intercom and tape deck), and teacher overhead projector. A final room alteration was the construction and hanging of screens. The screens were made with 3/4" flakeboard covered with eggshell white Formica which provided an excellent projection surface that was both durable and washable. The screens, which were attached to the classroom walls and ceiling at an anti-keystoned angle (tilted forward at the top to produce a squarely projected image from an overhead projector) were not mounted until the student desks and overhead projectors were in place. This was necessary to insure projected images of similar size and shape throughout the room. All room alterations were contracted to a local carpenter.

Electronic Feedback System

An electronic feedback system was constructed and installed in the Visual Response System. At the teacher's desk, a control console (see Fig. 4) was constructed which contained a master "on-off" switch for all student overhead projectors, eight "on-off" switches for individual student overhead projects, eight electro-mechanical counters, eight four-position toggle switches, eight red call lights, and a digital clock. A sound system was also located at, and controlled from, the teacher's desk. The sound system included a Craig cassette tape deck and an intercom. The sound system was controlled through the intercom to enable students to listen to music as well as receive individual instructions and/or feedback without interrupting other students.

A student feedback unit (see Fig. 6) was mounted in each student desk. These units included a red light, a green light, an electro-mechanical counter, a call button, and jacks for a headphone/microphone headset assembly. The red and green lights and the counters were operated by the toggle switches at the teacher's control console. The electronic feedback system was constructed by a local electronics firm. Schematics of the electronic feedback system were not available at the time this final report was being compiled but will be available from the project director in the near future.

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[1]Figure 5 shows the dimensions for a teacher's desk for a 10-student Visual Response System. The Buckeye Youth Center Visual Response System teacher's desk is as shown in Fig. 5, except: (1) there are no drawers or storage slots; (2) the length of the desk is 60"; and (3) the length of the central console is 28".

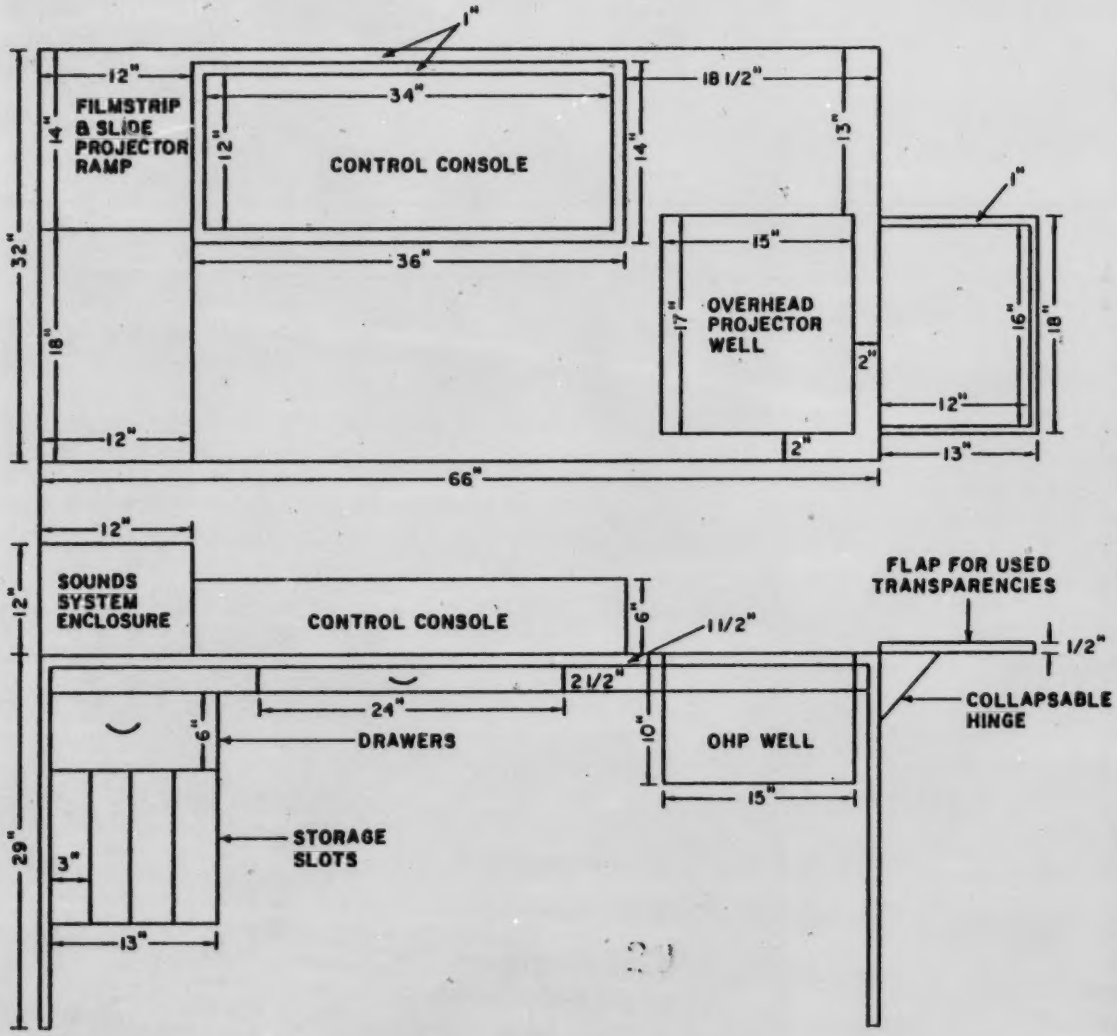


Fig. 5 - Top and front view of Visual Response System teacher's desk

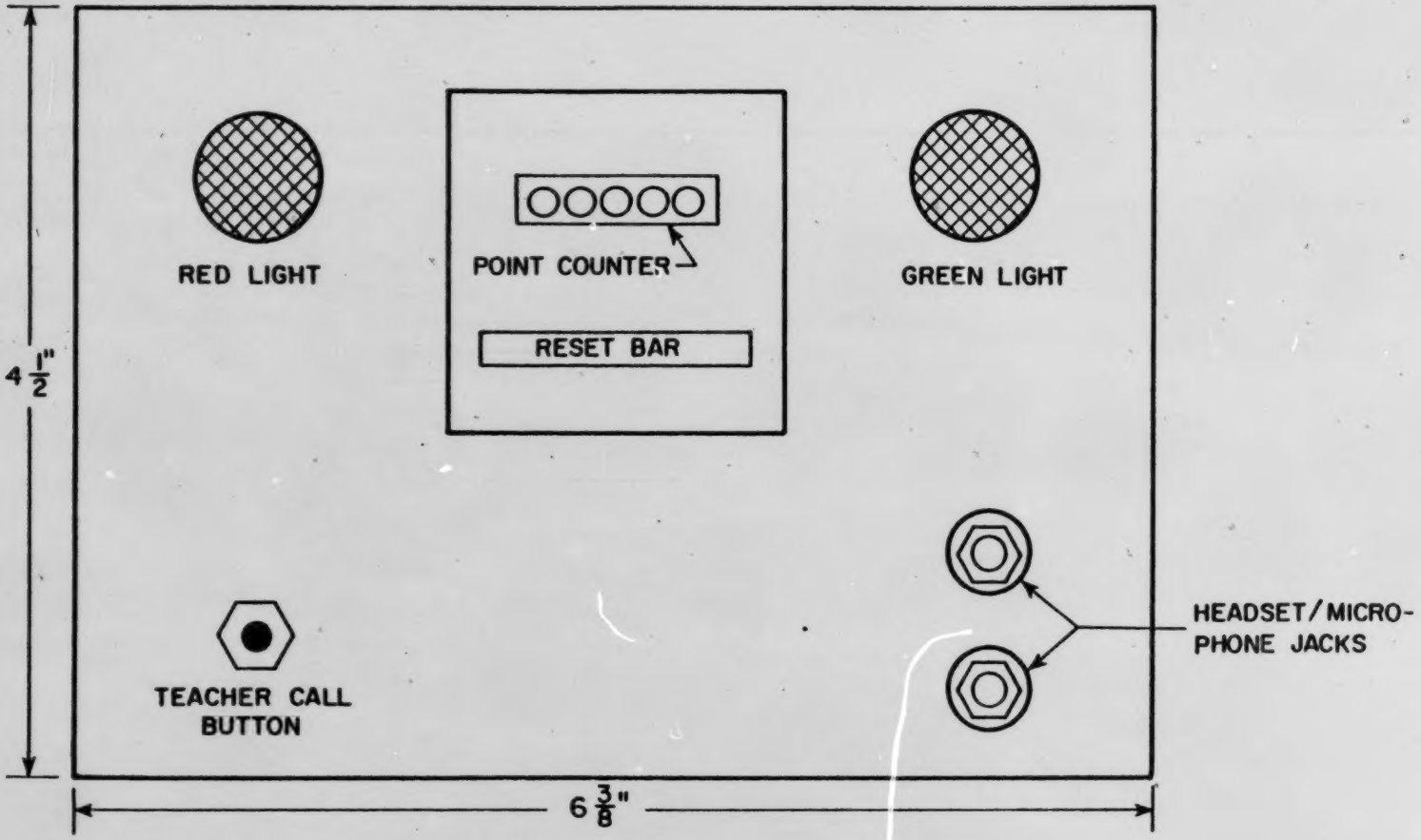


Fig. 6 - Visual Response System student feedback unit

## Student Overhead Projectors and Desks

Nine overhead projectors (3M model No. 213 B.E.D.) and eight overhead projector desks (also 3M), which were used as student desks, were purchased for the Visual Response System. Student desks were secured to the false floor. At this point, the screens were mounted, the electronic feedback system was installed, and all electrical wiring was completed.

The entire construction process took approximately four months. Unreasonable weather conditions in central Ohio caused several delays in construction. It is estimated that a Visual Response System classroom can be constructed in approximately two months time.

## Cost Breakdown

Table 2 shows a breakdown of equipment and construction costs for The Buckeye Youth Center Visual Response System. Note that the electrician's time was donated by the Ohio Youth Commission and our estimate for electrician fees is based upon the number of hours the in-house electrician spent working in the room times the average hourly union wage rate for electricians in Columbus, Ohio. Also, these figures represent an eight-student Visual Response System constructed with top-line equipment. Equipment and construction costs will vary depending on number of student stations and make and model of equipment.

## Maintenance

The Visual Response System was operational on May 1, 1978. All Buckeye Youth Center faculty and project staff who used the room from that date until the project terminated on December 31, 1978 were asked to complete a maintenance log (see Appendix I) after each Visual Response System class session. The maintenance log allowed project staff to estimate the number of class periods the Visual Response System was used as well as the number of hours the projectors were "on." It cannot be said with certainty what percentage of teachers who used the Visual Response System actually completed the maintenance log.

Table 3 shows the number of hours each projector in the Visual Response System was "on" according to the maintenance logs. (The maintenance log required teachers to check which projectors were used during the class period and to estimate how many minutes they were actually energized.) A total of eight overhead projector bulbs were replaced during the project period resulting in a bulb-life estimate of 91.3 hours. This is considerably less than the approximate 170 hours bulb-life cited in 3M specifications. At least three reasons may have contributed to the low bulb-life estimate. First, the overhead projectors in a Visual Response System classroom are usually turned "on" and "off" many times during a single class period, adding to wear on the bulb. Second, the overhead

Table 2. Equipment and Construction Costs for Buckeye Youth Center Visual Response System

| | | |
|---|---|---|
| **Projectors/Student Desks** | | |
| Overhead projectors - 9 @ $375.00<br>3M Model #213 B.E.D. | | $ 3,375.00 |
| Student desks - 8 @ $123.50<br>3M overhead projector desk | | 988.00 |
| 35mm slide projector w/3" lens<br>Kodak Model #760 w/remote<br>control and auto-focus | | 195.00 |
| Filmstrip projector w/3" lens and<br>remote control - DuKane | | 156.00 |
| | SUBTOTAL | $ 4,714.00 |
| **Room Alterations** | | |
| Includes false floor, carpeting,<br>projection surfaces, and<br>custom-built teacher's desk | | $ 3,000.00 |
| | SUBTOTAL | $ 3,000.00 |
| **Electronic Control/Feedback System** | | |
| Teacher's control console and<br>student feedback units | | $ 1.362.99 |
| Cassette audio tape deck<br>Craig #5201 | | 162.78 |
| Intercom, Talk-A-Phone Model K-ML-10 | | 93.00 |
| Headphone/Microphone headsets<br>10 @ $23.75, Telex #61630-10 | | 237.75 |
| | SUBTOTAL | $ 1,856.52 |
| **Electrical Work** | | |
| Electrical parts, includes wire,<br>switches, relays, conduit, etc. | | 343.08 |
| Electrical Work<br>donated by Ohio Youth Commission | | |
| | SUBTOTAL | $ 343.08 |
| | TOTAL | $ 9,913.50 |
| Estimate of electrical work<br>Approximately 47 hrs. @ $22.00/hr. | | $ 1,034.00 |
| | ESTIMATED TOTAL COST OF VISUAL RESPONSE SYSTEMS INCLUDING ELECTRICAL WORK | $10,947.00 |

Table 3. Hours of Operation ("On" Time) for Visual Response System Projectors During Project Year

| Overhead Projector | 5/78 | 6/78 | 7/78 | 8/78 | 9/78 | 10/78 | 11/78 | 12/78 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| Teacher | 16.6 | 19.1 | 20.0 | 20.3 | 12.1 | 19.3 | 7.0 | 17.9 | 132.3 |
| 1 | 10.4 | 11.9 | 17.2 | 8.4 | 7.3 | 11.8 | 3.0 | 9.9 | 69.9 |
| 2 | 10.8 | 12.5 | 16.5 | 7.7 | 3.8 | 10.9 | 3.3 | 12.7 | 78.2 |
| 3 | 5.9 | 10.8 | 13.3 | 7.3 | 2.3 | 11.4 | 3.2 | 5.4 | 59.6 |
| 4 | 13.8 | 15.9 | 13.2 | 9.9 | 7.2 | 15.3 | 1.8 | 9.9 | 87.0 |
| 5 | 4.9 | 12.4 | 17.1 | 6.5 | 8.0 | 15.1 | 3.7 | 10.8 | 78.5 |
| 6* | 11.9 | 7.8 | 8.6 | 5.4 | 2.7 | 10.3 | 2.6 | 11.9 | 61.2 |
| 7 | 12.9 | 13.8 | 17.4 | 6.8 | 9.8 | 13.5 | 2.8 | 6.3 | 83.3 |
| 8 | 5.8 | 11.2 | 17.3 | 8.7 | 9.8 | 12.6 | 3.3 | 11.8 | 80.5 |
| Slide Projector | | | 2.3 | 2.8 | | .2 | | .2 | 4.5 |
| Filmstrip Projector | | | 3.2 | .8 | | .2 | | | 4.2 |

* left-handed desk

projectors used in this project have a two-position switch for "high" and "low" intensity. While students were asked to keep these switches in the "low" intensity position, which increases bulb-life and which is the setting in which 3M reports the 170 hour bulb-life, the switches were sometimes found in the "high" intensity position. Third, not all teachers who used the Visual Response System completed the maintenance log, although it is believed the majority did. Any periods that the Visual Response System was used and for which a maintenance log was not completed would mean actual bulb-life was higher than the reported 91.3 hours.

Besides replacing the eight overhead projector bulbs mentioned above, only one other maintenance effort was required during the project year to keep the Visual Response System operating at full capacity. (Not including, of course, such regular upkeep and cleaning efforts such as cleaning overhead projector stages, cleaning the recording and playback heads on the cassette tape deck, and vacuuming the floor.) After approximately six months of operation, one of the headphone/microphone headsets became inoperable. No attempt was made to repair the headset (original cost $23.78) since the project had originally purchased one spare.

# III. INSTRUCTIONAL DEMONSTRATION AND EVALUATION OF THE VISUAL RESPONSE SYSTEM

Section II dealt with the design and development of the Visual Response System. This section documents the efforts of project staff to demonstrate and evaluate the instructional effectiveness of the Visual Response System. Visual Response System instructional programs covering a variety of subject areas were developed and evaluated. Descriptions and evaluation data on each program are presented in this section. Results of a study on student-student interaction in the Visual Response System and a summary of student reactions to the Visual Response System are also included in this section of the Final Report.

Before reporting the results of project studies, some background information is necessary regarding the setting, students, and teachers involved in the Visual Response System project.

## Setting/Students

Instructional programs/units were conducted in an eight-student Visual Response System at H. H. Goddard High School in Columbus, Ohio. For a description of the Visual Response System, see Section II. H. H. Goddard is an accredited high school, located within The Buckeye Youth Center. Buckeye Youth Center is a residential treatment facility for juvenile offenders under the direction of the Ohio Youth Commission. The facility provides educational and residential treatment for 200 adjudicated males, 14-18 years of age.

The main programming for the youth is the chartered high school. H. H. Goddard High School offers all basic courses needed to meet state standards for graduation. The curriculum is individualized to meet the needs of each student. Federally sponsored Title I programs, as well as classes for the educable mentally retarded, are available to students. At the time of student discharge, all credit earned while at the school is transferable to any Ohio public school.

All of the students have been adjudicated by juvenile courts throughout the State of Ohio. Committed offenses range from larceny to manslaughter. Most of the students have demonstrated severely dysfunctional behavioral handicaps due to emotional, mental, or physical impairments. All students have had serious educational problems. Twenty-seven (27) students have been labeled educable mentally retarded. There are 80 students classified as learning disabled. According to school administrators, the remainder of the school population is classified as emotionally disturbed/behavior disordered.

## Teachers

Project staff members were teachers in all evaluation studies except two--the pilot for the photosynthesis study and the employment application program. The teacher for the photosynthesis pilot study was a regular science teacher at Goddard High School. Due to scheduling problems, a project staff member taught the final study of photosynthesis. The employment application teacher was a graduate student at The Ohio State University who developed and taught the unit as her Masters thesis.

Project staff members were all graduate students at The Ohio State University working in the Faculty for Exceptional Children. Seven staff members were pursuing Master's degrees in the Mildly Handicapped Program while one member was pursuing a Ph.D. in special education.

## Employment Applications

A program was developed to teach mildly retarded, juvenile delinquents to complete employment applications.

An item analysis was performed on employment applications obtained from 30 employers in Franklin County, Ohio (e.g., fast food chains, department stores, city maintenance, parks and recreation, service stations, factories, etc.). Any item that appeared on 20% or more of the sample applications was included in the Master Employment Application (see Appendix II). When the same item was presented in various formats on the sample applications (birthdate, date of birth, etc.), the format in which the item was most commonly presented was used for the Master Employment Application. The Master Employment Application included 34 items, each of which was scored each time a student completed the form. To be scored correct, all of the information requested by an item had to be legibly printed in the format required by the item. Students' school records were examined to determine correct responses.

## Procedure

Pretest. Students were given 30 minutes to complete the Master Employment Application in paper and pencil in a regular classroom setting. Subsequent administrations of the Master Employment Application and the generalization pre- and posttests were also done in paper and pencil in a regular classroom.

Generalization pretest. In addition to the Master Employment Application pretest, students also completed 3 actual employment applications chosen from the sample of 30 applications. The three generalization applications were selected because they were representative of the range of application formats included in those obtained from local employers. The generalization applications were from a utility company, a fast food chain,

and a movie theatre. One of the generalization applications was administered on the same session as the Master Employment Application pretest, the remaining two were given the next school day. Students were given 30 minutes to complete each of the generalization applications.

Training procedure. A nine-step training procedure (see Appendix II) that proceeded from an initial matching task to writing responses to the various items on an overhead transparency made from the Master Employment Application was used. Each of the nine steps--except for Step 7, the first step where the students were required to write--was repeated until all students responded with 100% accuracy. Approximately 90% accuracy was required of each student in Step 7 before Step 8 was started. The entire nine-step training procedure was repeated for each set of items. A total of eleven 45-minute instructional sessions were required to complete training on all four sets of items.

Points earned by each student were exchanged for lottery tickets (10 points = 1 ticket) which were drawn each Friday, and after the last instructional session of the program, until three winners had been selected. Winners could choose either a soft drink or a rock 'n roll poster. Non-winning tickets were discarded after each drawing. An off-grounds bowling trip was given to each student who completed the employment application program. The bowling trip was not contingent upon performance in the program.

Generalization posttest. The three generalization applications were completed by the students after the training program was completed. One of the generalization applications was administered right after the students completed the Master Employment Application following training on Set 4, the remaining two were given the next day.

Two-week follow-up. Two weeks after the training program was completed, the students were asked to again complete the Master Employment Application.

## Materials

In addition to the Master Employment Application, the teacher and students used the following materials during certain instructional sessions.

Master Item Transparencies. The Master Item Transparencies were overhead transparencies divided into nine squares with removable masks enabling the teacher to project one item at a time. Each item was an exact duplication of the format in which that item appeared on the Master Employment Application. One Master Item Transparency was used for each of the four sets of items.

Variation Item Transparencies. Variation Item Transparencies were like the Master Item Transparencies except each item appeared in a format

other than the way it was presented on the Master Employment Application (e.g., Social Security Number, Social Security No., S.S. #). At least one Variation Item Transparency was used for each of the four sets of items.

Master Item Student Response Slides. Master Item Student Response Slides were small transparencies mounted in 2" x 2" cardboard slide mounts. Each response slide had one item printed on it as that item appeared on the Master Employment Application.

Personal Information Student Response Slides. Personal Information Student Response Slides were like the Master Item Response Slides above, except each slide contained a student's personal information for an item (e.g., 166 lbs, 365-52-8464, etc.).

## Evaluation Procedure

A multiple-baseline-across-behaviors design was used to evaluate the effectiveness of the instructional program. The 34 items comprising the Master Employment Application were divided into four sets (see Table 4). Each of the four sets of items was taught in succession. Each time the instructional program was completed for a set of items, the students were readministered the entire Master Employment Application. Data from the subjects' performance each time they completed the Master Employment Application were used in the multiple baseline analysis.

Interobserver reliability. A second, independent observer graded all of the Master Employment Applications completed by the students during the pretest and during the probe following training on Set 2. Reliability was computed by dividing the number of items on which both graders agreed by the total number of items attempted and multiplying by 100. Reliability on the pretest was 100% on the applications completed by six of the students and 91% for Student 2. Reliability on the probe conducted after Set 2 was 100% for Students 1, 2, 3, 6, and 7, 96% for Student 4, and 90% for Student 5.

## Results

Figure 7 shows the average number of items completed correctly by each of the seven students on the Master Employment Application across the four sets of items. Mean performance of the seven students is presented because it is fairly representative of each student's behavior; except for Student 6 who completed 26 items correctly on the pretest and inflated the pretest group means and most of the baseline means on subsequent probes as well. The students averaged 13.9 (range, 5-26) items correct on the pretest, 31.4 (range, 26-34) correct on the probe following instruction on Set 4, and 31.7 (range, 29-34) correct on the two-week follow-up.

Table 4. Items of Biographic Information Comprising the Master Employment Application

Set 1

1. Name -- Last, First, Middle
2. Date of Birth
3. Age
4. Social Security Number
5. Sex -- M F
6. Phone Number
7. Married -- Yes No
8. Weight
9. Height

Set 2

1. Are you a citizen of the U.S.?
2. No. of dependents
3. Present Address -- No. Street City State Zip Code
4. Previous Address -- No. Street City State Zip Code
5. Do you have any physical disabilities? If yes, describe.
6. Have you had any major illness in the past 5 years?
   If yes, describe _____.
7. In case of an emergency notify -- Name Address Phone No.

Set 3

1. Education --- Name of School Attended (From-To) Did you graduate?
   a. Elementary
   b. High School
   c. College or University
   d. Other
2. Do you plan to continue your education?
3. Last grade completed
4. Grade Point Average
5. List any special office skills that you have
6. List below your last three employers:
   Name and Address Salary Position Date (From-To)
7. Have you ever served in the U.S. armed forces? Yes No
8. List below three names of people not related to you, whom you have known at least one year.
   Name Address Phone No. Years Acquainted
9. Date

Set 4

1. Do you have any relatives in this company?
2. Type of work desired
3. Date available Hours available
4. Starting expected salary
5. Why do you want this job?
6. Have you committed any felonies or violations? If yes, explain
7. Are you a licensed driver? Yes No
8. List here any additional comments that you think are important to us in considering you for employment:
9. Signature

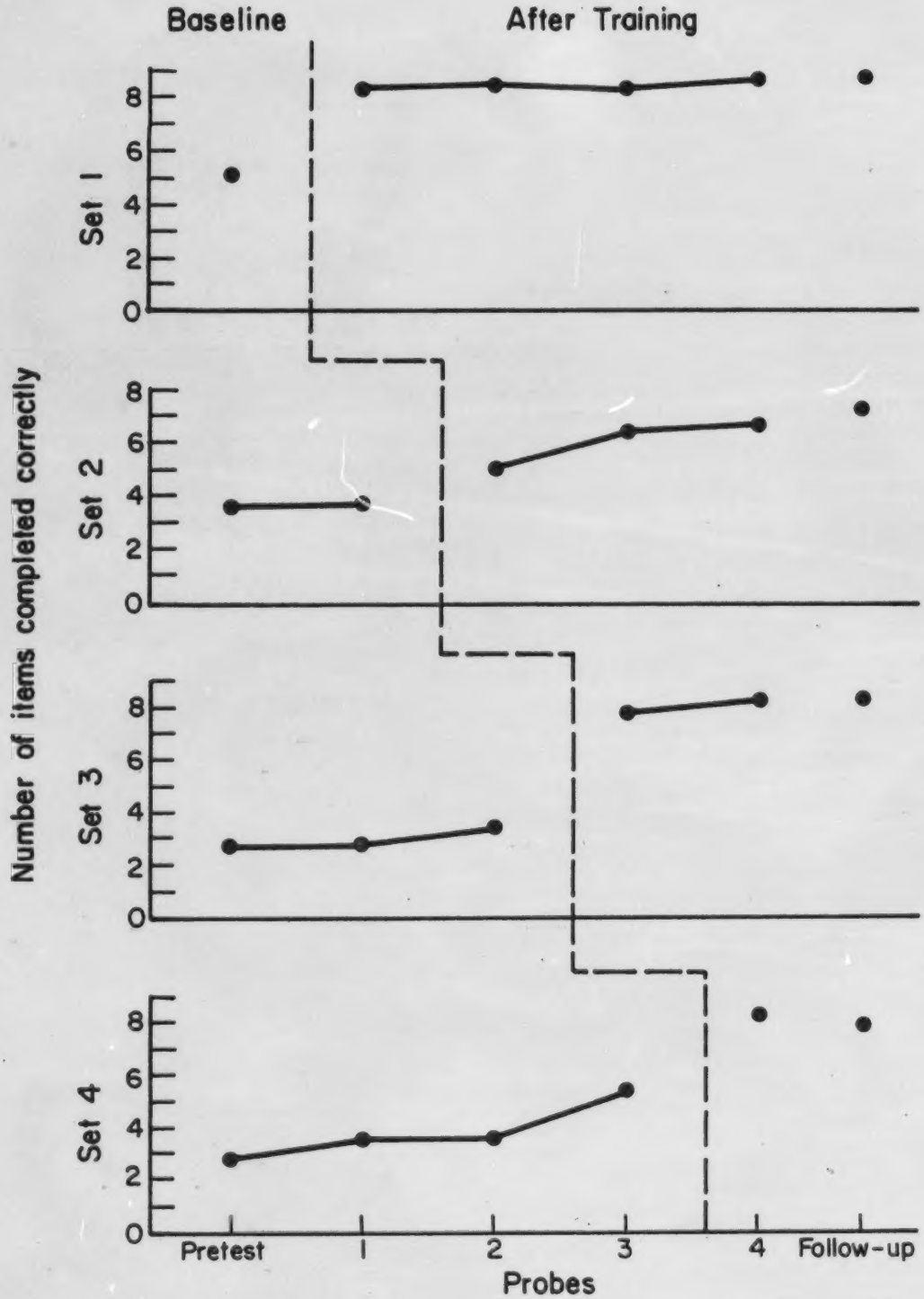


Fig. 7 - Averages of the number of master job application items completed correctly by all subjects before and after training

Table 5 shows the students' performances on the generalization applications. All seven students increased the number of items completed correctly over their pretest scores on all three generalization applications.

## Discussion

Results of this study show the instructional program was effective in teaching mildly retarded, juvenile offenders to complete the Master Employment Application. After training was conducted on all four sets of items, two subjects completed all 34 items correctly, two completed 32 items correctly, and the remaining three subjects completed 29 items correctly. One factor may have worked to keep the subjects' scores lower than they might have been on the Master Employment Application. Although the subjects were told at the beginning of the program that they would be asked to complete the Master Employment Application a number of times, training progressed so rapidly that sometimes only two days separated subsequent administrations of the Master Application, resulting in the subjects complaining on several occasions of having to complete the form too often. Whether the subjects' voiced dissatisfaction with that aspect of the program affected their performance on the Master Application cannot be determined. However, to guard against such effects, the subjects probably should have been given a certain number of points contingent upon completing the Master Application during the pretest and each subsequent probe, similar to what was done by Clark, Boyd, and Macrae (1975). As it was, no reinforcement or feedback of any kind was given to the subjects for their efforts on the Master Employment Application.

Students did not show as much improvement on the second set of items as they did on the other three. This may have been a function of the difficulty of the items themselves (three complete sets of addresses were required) or the fact that the school was closed for two days during training on Set 2. In either case, students' scores on Set 2 increased on subsequent administrations of the Master Employment Application. Further research on the training program is needed to determine whether or not different instructional steps are needed to teach addresses.

While students' scores on the three generalization applications improved after training, they did not do as well as they did on the Master Employment Application. This fact suggests that practice completing various applications should be included in the training program as was done by Clark, Boyd, and Macrae (1975).

Although both the training program used in this study and the one reported by Clark and his colleagues (1975) were based on active student response, reinforcement, and corrective feedback, the technology provided by the Visual Response System offered several distinct advantages to this program. First, since each student's response was projected on the screen behind him, the teacher simply had to scan the room to get visual access to all students' work. Correct responses were reinforced almost instantly on many trials since the teacher only had to move a switch at her desk in

Table 5. Students' pre- and posttest scores on three generalization employment applications trained items only

| Subject | Utility Company (14)[a] | | Fast Food Store (16) | | Movie Theatre (20) | |
|---|---|---|---|---|---|---|
| | Pretest | Posttest | Pretest | Posttest | Pretest | Posttest |
| 1 | 12 | 14 | 7 | 14 | 10 | 17 |
| 2 | 9 | 10 | 8 | 10 | 5 | 8 |
| 3 | 8 | 13 | 2 | 5 | 4 | 7 |
| 4 | 8 | 13 | 6 | 15 | 10 | 16 |
| 5 | 6 | 11 | 3 | 7 | 6 | 8 |
| 6 | 12 | 14 | 7 | 15 | 15 | 18 |
| 7 | 7 | 14 | 4 | 6 | 5 | 7 |
| Mean | 8.9 | 12.7 | 5.3 | 10.3 | 7.9 | 11.6 |

[a]Numbers in parentheses are the number of items included in the generalization application that were included in the Master Employment Application.

order to advance a student's point counter. Reinforcement delay was never more than several seconds on most trials. In the Clark et al. study, the teacher had to move about the room, attending to youths who raised their hands. In addition to taking more time, such a procedure increases reinforcement delay, required students to emit longer series of responses before receiving feedback, and usually means fewer total learning trials per student per unit of time can be accomplished.

Second, because students in the Visual Response System could see each other's work when the overhead projectors were "on" during feedback, corrective remediation directed toward one student may have served as a functional consequence for other students. On many occasions, a student who had made an error similar to one committed by a peer would self-correct his response after he had seen the teacher help remediate his peer's work.

This aspect of student-student interaction in the Visual Response System may have been responsible for some of the changes in handwriting neatness observed in some of the subjects. While handwriting was not a training variable in this study, the teacher did provide verbal praise for neatness in Step 8. Since a student's peers could see the topography of writing behavior that was producing praise, a modeling effect may have improved their writing as well.

Finally, the Visual Response System, which enabled every student to respond to every stimulus presented by the teacher, made it possible to train a larger number of items in less time than was required by Clark, Boyd, and Macrae (1975). Based on the amount of time spent in training, Clark et al. estimated that "an average of 12 items of biographic information could be taught to disadvantaged students within a six-week term involving two 30-minute sessions daily." (p. 73) This is a training rate of 2.5 hours per item for one teacher and six students. The Visual Response System enabled one teacher to train 34 items to seven students in 8 hours and 15 minutes, a training rate of about 24 minutes per item. Of course, it is difficult to compare training rates because of differences in subjects and other variables involved in the two studies, but the large difference suggests the Visual Response System as an efficient technology for this type of instruction.

At present, the employment application is being modified to improve generalization. Students can be taught to fill out the Master Employment Application but more attention to programming for generalization is necessary. The unit is also being modified to allow students to participate only in those sets that are necessary as indicated by a pretest. In addition, the unit on completing employment applications is the starting point for developing a larger Visual Response System program on obtaining employment. The employment skills program will entail reading newspaper want ads to locate potential jobs, filling out employment applications, and interviewing for a job. This last section on interviewing for a job will be conducted in both the Visual Response System and the students' regular classroom.

## Composition

This study developed from previous research on syntactical construction used by students at various ages. Hunt (1964) determined the length of a writer's T-units indicated syntactical maturity. A T-unit is defined as an independent clause plus one or more dependent clauses, phrases, or other related sentence fragments. Increasing the length of T-units in a high school student's writing is accomplished most effectively by increasing the use of dependent clauses. However, in this study an attempt was also made to increase use of phrases and single word modifiers.

Subjects were given immediate feedback and reinforcement for use of desired syntactic structure. Subjects were also given feedback and reinforcement for eliminating grammatical errors. It was reasoned that achieving more mature writing that was still grammatically poor would be of questionable significance. The study's emphasis on feedback and reinforcement was unique. Most programs of compositional instruction rely heavily on stimuli presented as instruction prior to actual writing by the student.

The objectives of the study were:

1. To examine the relationship of immediate remedial feedback and reinforcement to the development of, or increased usage of, more complex syntactical forms and the elimination of grammatical errors.

2. To examine the effect of the Visual Response System as a teaching environment with mildly handicapped students in the delivery of individualized instruction, feedback and reinforcement contingent on students' compositional performance.

3. To determine the amount of generalization that occurs in the writing behavior of students from the Visual Response System to the regular classroom.

## Materials

A minimum of materials were required to carry out the study. Student responses were made on a clear sheet of acetate overlaying a lined acetate transparency. Students used non-permanent markers designed for writing on acetate. Different stimuli were shown for each writing trial and students were asked to write a story about the projected picture.

## Evaluation Procedure

The study employed the single-subject design paradigm with a multiple baseline across behaviors. A baseline measure on all dependent variables --grammatical errors, single word modifiers, phrases, and subordinate

clauses--was taken. Feedback and reinforcement were then applied to each variable sequentially in the order listed above. The resulting frequency of occurrance of each variable was calculated and graphed. Changes in the frequency of each variable following implementation of treatment served as the evaluation mechanism.

## Results

Resultant data for each of the five subjects in the study are summarized below.

Rate. Table 6 lists average words written per minute (rate) per 5-minute trial per experimental phase by each subject. All subjects increased their writing rate during the course of the study. Subject 5 increased his rate by less than one word per minute from baseline to the final phase, while Subject 2 increased his rate by 6.74 words/minute. The highest mean rate for all subjects combined was 13.24 in subordinate clauses compared to the lowest mean of 9.65 in baseline.

Error density. Table 7 lists number of errors per T-unit (error density) per 5-minute trial per experimental phase by student. Error density decreased for all subjects after the baseline phase. The smallest change was seen in Subject 2, from 2.06-1.24. The largest change was shown by Subject 4, from 1.85-0.48.

Single word modifiers per T-unit. Table 8 lists the number of single word modifiers used per T-unit per 5-minute trial per experimental phase by subject. Subject 1 had the largest increase in single word modifiers from .82 in baseline to 2.24 in subordinate clauses, and the smallest increase was shown by subject 4, from 1.69 in baseline to 2.20 in intervention. Subject 1, 2, and 5 scored highest on the variable during subordinate clauses rather than during intervention. The group mean ranged from 1.21 in baseline to 2.25 in intervention.

Phrases per T-unit. Table 9 lists the number of phrases per T-unit per 5-minute trial per experimental phase by subject. The degree of change for all subjects in the number of phrases used as minimal. Subjects 1 and 5 used fewer phrases per T-unit during intervention than during baseline. Subject 4 increased use of phrases from .96 in baseline to 1.44 during intervention. The lowest group mean was .79 in single word modifiers.

Subordinate clauses per T-unit. Table 10 lists the number of subordinate clauses per T-unit per 5-minute trial per experimental phase by subject. All subjects showed increases in the use of subordinate clauses during the intervention phase. Subject 4 had the smallest increase from .41 in baseline to .74 in intervention. Subject 3 increased from .36 in baseline to 1.23 in intervention. The group mean was .81 in intervention as compared to baseline, the next highest phase, with a mean of .21.

Table 6. Average words written per minute (rate) per 5-minute writing trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | 11.11 | 10.07 | 12.84 | 11.57 | 14.57 |
| 2 | 7.32 | 9.03 | 12.01 | 13.30 | 13.79 |
| 3 | 12.39 | 12.01 | 11.60 | 11.27 | 12.51 |
| 4 | 8.37 | 9.17 | 10.56 | 11.80 | 12.99 |
| 5 | 9.07 | 8.69 | 10.89 | 12.8 | 12.33 |
| Average of All Subjects | 9.65 | 9.79 | 11.58 | 12.15 | 13.24 |

Table 7. Number of errors per T-unit (error density) per 5-minute trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | 2.12 | .65 | .67 | .60 | .94 |
| 2 | 2.06 | 1.27 | 1.25 | 1.24 | 1.39 |
| 3 | 1.21 | .45 | .44 | .31 | .43 |
| 4 | 1.85 | .68 | .82 | .69 | .48 |
| 5 | 1.18 | .59 | .85 | .54 | .70 |
| Average of All Subjects | 1.68 | .73 | .81 | .68 | .79 |

Table 8. Number of single word modifiers used per T-unit per 5-minute trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | .82 | 1.05 | 1.95 | 1.41 | 2.24 |
| 2 | .79 | 1.26 | 1.87 | 1.62 | 1.99 |
| 3 | 1.60 | 2.05 | 2.64 | 2.59 | 2.35 |
| 4 | 1.69 | 1.79 | 2.20 | 1.57 | 1.64 |
| 5 | 1.17 | 1.53 | 2.59 | 2.78 | 2.81 |
| Average of All Subjects | 1.21 | 1.24 | 2.25 | 1.99 | 2.20 |

Table 9. Number of phrases per T-unit per 5-minute trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | .80 | .73 | .47 | .75 | .67 |
| 2 | .72 | .73 | .61 | .91 | .85 |
| 3 | 1.42 | 1.13 | .89 | 1.70 | 1.16 |
| 4 | .96 | 1.33 | 1.07 | 1.44 | 1.25 |
| 5 | 1.14 | .91 | .93 | 1.12 | 1.14 |
| Average of All Subjects | 1.01 | .97 | .79 | 1.18 | 1.01 |

Table 10. Number of subordinate clauses per T-unit per 5-minute trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | .13 | .08 | .05 | .11 | .59 |
| 2 | .04 | .20 | .08 | .14 | .77 |
| 3 | .36 | .22 | .09 | .17 | 1.23 |
| 4 | .41 | .18 | .28 | .19 | .74 |
| 5 | .11 | .11 | .06 | .08 | .75 |
| Average of All Subjects | .21 | .16 | .11 | .14 | .82 |

Average T-unit length. Table 11 lists average T-unit length per 5-minute writing trial per experimental phase by subject. Average T-unit length reached its highest mean in subordinate clauses for all subjects. The smallest increase was from 11.59-12.26 for Subject 4, and the largest was 8.43-11.72 for Subject 2. The group mean was 10.36 during baseline and 12.48 during subordinate clauses. The smallest group mean was 9.54 in error density.

For a sample of a student graph, see Appendix III. For more detailed information and results on this study, see Cowardin (1978).

## Discussion

A study was conducted in which five boys attending a high school within a state-operated residential treatment facility for juvenile offenders were taught to reduce grammatical errors and incorporate writing. Subjects were shown a picture stimulus and asked to write for five minutes about what they saw or about any subject they wished. After baseline of the study, reinforcement, in the form of points for which back-up reinforcers could be purchased at a later time, and feedback, were given sequentially for grammatical errors, single word modifiers, phrases, and subordinate clauses in separate phases.

The measure of syntactic maturity used in the study was the length of "terminable" units (T-units) in the subject's writing. For each writing sample, the average length of the T-units number of errors per T-unit, (error density), single word modifiers per T-unit, phrases per T-unit, and subordinate clauses per T-unit were counted. After baseline data were collected, subjects were instructed in separate sequential phases to reduce grammatical errors, and increase use of single word modifiers, phrases and subordinate clauses. About 15 minutes was spent explaining each variable, but after each writing trial exemplars of the variable used were listed for each student.

Results showed the procedure of minimizing time of instruction, but maximizing remedial feedback and positive consequences were effective. Error density decreased by a significant degree for all subjects. Single word modifiers and phrases decreased also, but no significance can be claimed. However, use of subordinate clauses did increase by a significant amount. Average T-unit length for all subjects was highest in the subordinate clauses phase, supporting Hunt's hypothesis that increase in syntactic maturity for students in grades 4-12 is most affected by increased use of subordinate clause.

Results also support the hypothesis that instruction on grammar tends to decrease the complexity of students' writing as measured by T-unit length. All but one student decreased T-unit length after baseline. However, since a significant increase in use of subordinate clauses in the last phase did not raise error density appreciably, it is suggested that the inverse of that hypothesis, that increased syntactical maturity would

Table 11. Average length of T-unit per 5-minute writing trial per experimental phase by each subject

| Subject | Baseline | Error Density | Single Word Modifiers | Phrases | Subordinate Clauses |
|---|---|---|---|---|---|
| 1 | 8.19 | 7.78 | 8.19 | 8.45 | 10.41 |
| 2 | 8.43 | 9.43 | 8.66 | 9.46 | 11.72 |
| 3 | 12.81 | 10.52 | 11.31 | 12.61 | 14.33 |
| 4 | 11.59 | 10.85 | 11.44 | 11.28 | 12.26 |
| 5 | 10.79 | 9.11 | 10.93 | 11.48 | 13.69 |
| Average of All Subjects | 10.36 | 9.54 | 10.11 | 10.66 | 12.48 |

result in more grammatical errors, is not true. In this study, grammar and syntax were modified simultaneously with desirable and significant results.

This study also produced evidence that the Visual Response System is an effective teaching environment. Subjects raised their equivalent writing level by as much as 4 grade levels, as measured by average T-unit length, in the 10-week period. This growth was accomplished while using no teacher time outside class to correct papers or to prepare instructional materials, ordinarily a time consuming endeavor for teachers of composition. Subjects themselves wrote their own curriculum, and through the procedures made possible by the Visual Response System, one writing sample served as the instructional lesson for the next trial.

Three of the subjects were also asked to write compositions in their regular classroom on any subject they wished. The same measurements were made on these writing samples. Comparison with the Visual Response System measures showed a distinct difference in topics chosen to write about, in the length of T-units, the amount of errors, and use of single word modifiers, phrases, and subordinate clauses. When intervention was introduced in the Visual Response System, corresponding changes in the regular classroom were seen in error density, but little or no change was evident for other variables.

Many questions were generated by the outcomes of this study. How do different visual stimuli affect writing form? How can the variables used in this study be condensed into more manageable forms? How remedial feedback without reinforcement would affect writing? What type of student can benefit most using these procedures? These are just a few areas yet to be examined.

The major findings of this study were that simple procedures involving no teacher time outside of class can be effective in improving writing skills in the Visual Response System; that grammar and syntax can be taught simultaneously; that emphasizing performance and positive consequences can be effective in changing students' writing behavior; and that a generative grammar can be produced by these procedures, in that subjects produced novel responses from a response class as a result of reinforcement of exemplars in that class.

## Punctuation

Some preliminary data were taken on a Visual Response System program designed to improve students' use of punctuation marks. Punctuation was selected as an important area of intervention after assessment of students' baseline writing samples. Punctuation skills covered were capitalization and end punctuation, use of commas, use of quotation marks, and use of apostrophes. Five students participated throughout the study. (These five students were not subjects in the study on composition.)

Procedure

Two or three 10-minute writing trials were conducted in the Visual Response System per class day. The writing stimulus was a selected frame from the Adventures in Immagination (McGraw-Hill) filmstrips or a 35 mm color slide displayed via a slide projector. Students were asked to write sentences about the picture, but they were free to develop whatever story they wished. During intervention phases, writing sessions were preceded by a brief teacher presentation on the aspect of punctuation being studied that day. An exercise requiring written student responses followed (see Appendix IV for examples of teacher materials). Punctuation rules were adapted from those found in Underwood and Kett (1977).

At the end of each writing trial, points were administered by the teacher as she scanned the students' projected sentences. Points were used to purchase tickets for a weekly class lottery. During the first three sessions, students received points for simply writing. As the study progressed, specific contingencies required the students to write sentences containing proper usage of various punctuation marks.

As new punctuation marks were introduced, examples were projected by the teacher and students participated in an exercise requiring them to identify correctly and incorrectly placed marks as well as place the mark correctly in a series of teacher-projected sentences. The 10-minute writing trials followed these exercises.

Data from this program are still being compiled and analyzed. At this point, the program appears to have been moderately successful.

The program shows that a teacher can successfully work with a class of students having varied writing abilities. Exercises can be an introduction to a structure to some students and a review to others. Further study should be conducted on the setting of individual contingencies based on ability. This occurred to a limited extent in this study, but more thorough investigation is required. A practical method of recordkeeping should be devised, to remind the teacher and student of individual contingencies currently in effect.

In this study, no effort was made to remediate spelling errors. Some method of remediation should be devised to produce more readily visible changes in writing quality.

Special attention should be paid to the selection of a writing stimulus. Some students, particularly the less sophisticated writers, refused to write about certain stimuli. Troublesome stimuli included abstract pictures, pictures dealing with a historical event (e.g., Iwo Jima Memorial), pictures taken from a sport which the student does not follow, and pictures including the teacher. With this population, pictures of sports cars were particularly effective. Matching stimuli to the background and interests of the student population may be crucial to a successful creative writing program.

## Spelling

The objective of this program was to develop an effective method to teach spelling to regular and EMR secondary students in the Visual Response System. In addition, the unit was developed to fulfill a proposal goal to use the Visual Response System in teaching tool subjects.

The spelling program was developed by project staff with input from Buckeye Youth Center teachers.

### Materials

The following materials were used during each instructional session. For samples of materials, see Appendix V.

Teacher Transparencies. Teacher Transparencies were used to present spelling words in sentences and in isolation.

Student Response Slides. Student Response Slides are 2-1/4" x 2-1/4" acetate framed slides with a single lower case letter on each.

Student Response Transparencies. Two Student Response Transparencies were used each session. One with four numbered lines and the second with twenty numbered lines.

Pretest, Posttest, and Weekly Posttest Answer Sheets. Paper and pencil tests were administered in the Visual Response System using prepared lined answer sheets.

### Procedure

This program emphasized rapid student responses to visual memory tasks rather than phonics or linguistic patterns. Twenty words were taught per week, four per day. Regular students were pretested with a list selected by their classroom teacher of words commonly misspelled by ninth graders. EMR students were pretested with Fitzgerald's Basic Spelling Vocabulary for Slow Learners. A word was selected for the teaching list if it was correctly spelled by no more than one student in the class on the pretest.

See Appendix V for the teaching procedures used.

### Evaluation

A taped dictation of the full spelling list was made with words pronounced first in isolation, second in a sentence, and finally in isolation again. This tape was used for the daily pre-posttests throughout the program.

Following instructions the students were posttested on words from that day and pretested on words for the next two days. The next day students were pretested on that day's four spelling words as well as posttested on the previous day's words. Students were given immediate reinforcement via point counters for correct pre- and posttest response.

A multiple baseline across behaviors design was used to evaluate student scores on pre-posttests. Daily pretest scores were used as baseline data points. Posttest scores were recorded for the instructional day, the day following instruction, and the weekly posttest.

## Discussion of Results

Visual inspection of student graphs reveal a typical pattern shown by the regular students' graph (see Fig. 8). Students regularly learned the four words instructed that day as indicated by their posttest scores. When posttested the following day and again on the weekly posttest, a descending trend is apparent. This is an indication of poor maintenance.

The EMR students (Fig. 8) show an ascending baseline performance. This may have occurred because of repeated exposure to the words or as students became aware that words on the pretest would again be tested the next day they may have studied the words on their own.

Student results were inconsistent indicating a need for further research in the area. This was apparent with both regular and EMR students.

## Discussion

This spelling program was successful in teaching students four new words per day. In addition, follow-up interviews substantiated students enjoyed this Visual Response System program as a way to learn spelling.

Several program limitations are apparent. Although students learned to spell four new words each day, maintenance was poor, as reflected in the descending trend in posttest scores. This could possibly be remedied through the institution of a daily review procedure.

The program was originally conceived as a means for teachers to introduce a short list of spelling words related to a particular lesson. For example, a science teacher might use the procedure to teach students to spell organs of the body when presenting a unit on anatomy. Because it appears to take several sessions for students to become acclimated to the activity itself, this does not appear to be a realistic use of the program.

If the program is used as a regular on-going part of a secondary language arts program, the period of time required per day is perhaps unrealistic to a typical secondary schedule.

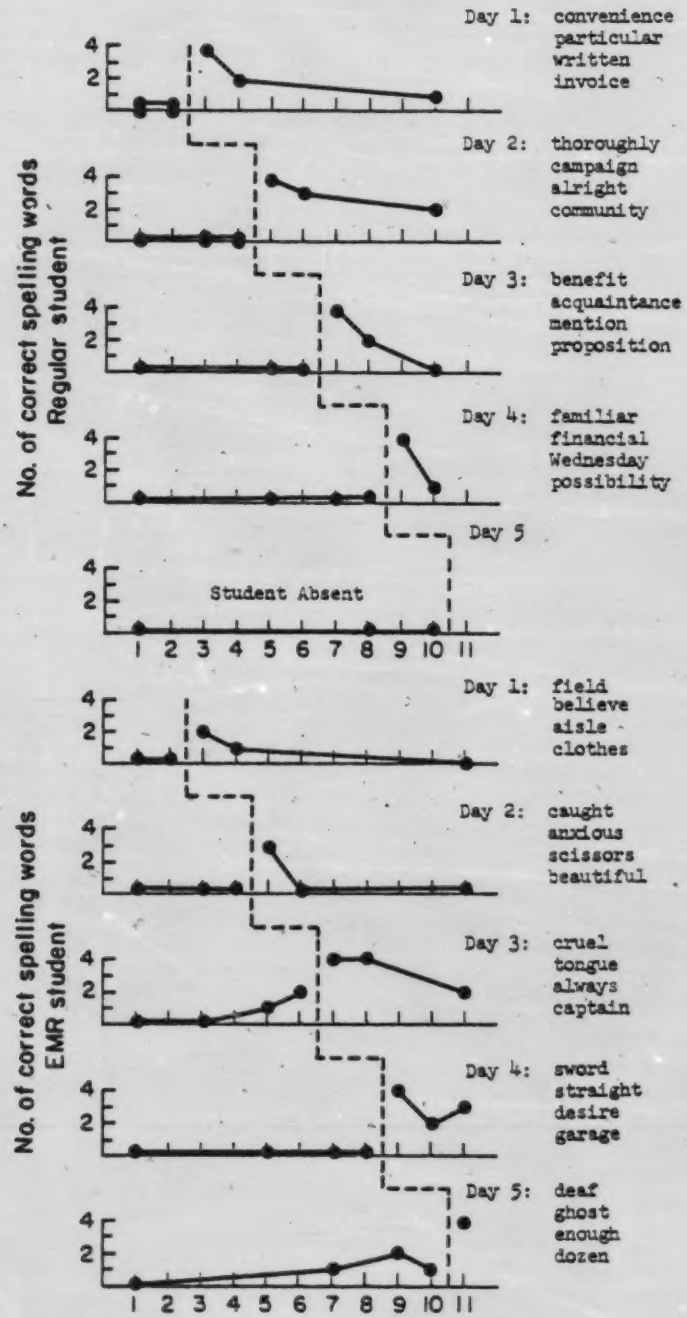
No. of correct spelling words
Regular student
Day 1: convenience particular written invoice
Day 2: thoroughly campaign alright community
Day 3: benefit acquaintance mention proposition
Day 4: familiar financial Wednesday possibility
Day 5
Student Absent
No. of correct spelling words
EMR student
Day 1: field believe aisle clothes
Day 2: caught anxious scissors beautiful
Day 3: cruel tongue always captain
Day 4: sword straight desire garage
Day 5: deaf ghost enough dozen
1 2 3 4 5 6 7 8 9 10 11

Fig. 8 - Number of spelling words correct per day by two students

Clarification from institution teachers on appropriate use and realistic time framework is needed before the program is modified. Possibly the Visual Response System could be used for spelling review activities or games while initial instruction is presented in the regular classroom.

While procedures in this program might be considered too time consuming for a secondary program, they may be effective and appropriate at the elementary level. The secondary students who participated in this program said they enjoyed manipulating the letter response slides. For students with a poor history of success in spelling, the program might prove reinforcing enough to be worth the time required.

## Mathematics--Fractions

This study was conducted to evaluate the effectiveness of a mediated instructional program designed to teach addition, subtraction, multiplication and division of fractions in the Visual Response System classroom. The program was developed using an already existing curriculum in fractions and developing activities and materials to adapt the curriculum to the Visual Response System classroom.

The objectives of the program were as follows:

### Fractions--Prerequisite Skills

1. The student will represent by a ratio what part a given number of objects is of a total set of objects.
2. The student will identify the objects in a set as indicated by a given ratio.
3. The student will represent the number one in the form of a fraction.
4. The student will count with fractions using the number line. The student will find points on the number line which correspond to a given fraction.
5. The student will write the consecutive multiples of a number.
6. The student will find the least common multiple of two or more numbers.
7. The student will find the prime factor of two or more numbers.
8. The student will find the greatest common factor of two or more numbers.

9. The students will change fraction to higher or lower terms.

10. The student will find the least common denominator for two or more fractions.

11. The student will rename mixed numbers and improper fractions.

Fractions--Addition

1. The student will add fractions with like denominators. Example: 1/2 + 1/2 =

2. The student will add mixed numbers with like denominators (no regrouping). Example: 1-1/2 + 1-1/2 =

3. The student will add fractions with unlike denominators. Example: 1/2 + 1/4 =

4. The student will add mixed numbers with unlike denominators. Example: 1-1/2 + 1-1/4 =

Fractions--Subtraction

1. The student will subtract fractions with like denominators. Example: 5/6 - 1/6 =

2. The student will subtract a fraction or a mixed number from a whole number. Example: 5-1/3 ; 4-3/4 - 1/4 =

3. The student will subtract mixed numbers with like denominators. Example: 5-7/8 - 2-3/8 =

4. The student will subtract fractions with unlike denominators. Example: 5-7/8 - 2-3/4 =

5. The student will subtract mixed numbers with unlike denominators (with regrouping). Example: 5-1/2 - 2-1/3 =

Fractions--Multiplication

1. The student will multiply a whole number by a fraction. Example: 4 × 1/2 =

2. The student will multiply fractions with numerators greater than one. Example: 3/5 × 4/9 =

3. The student will multiply a mixed number and a fraction. Example: 1-1/2 × 1/3 =

4. The student will multiply a mixed number or a whole number by a mixed number. Example: 1-1/2 × 1-1/3 = ; 6 × 7-1/6.

Fractions--Division

1. The student will divide a whole number by a fraction. Example: 5 ÷ 1/2 =

2. The student will divide a fraction by a fraction. Example: 1/2 ÷ 1/3 =

3. The student will divide a mixed number by a fraction. Example: 1-1/2 ÷ 1/5 =

4. The student will divide a fraction or a mixed number by a whole number. Example: 1/2 ÷ 2 = ; 1-1/2 ÷ 2 =

5. The student will divide a mixed number or a whole number by a mixed number. Example: 1-1/2 ÷ 1-1/3 = ; 12 ÷ 1-2/3 =

Materials

Transparencies were used to teach addition, subtraction, multiplication, and division of fractions. A total of 120 transparencies were developed to teach the fraction concepts. See Appendix VI for sample math transparencies. There were 21 different sets of student response transparencies. Fraction blocks were used as manipulative materials to teach basic fraction concepts, such as the concept of one whole, and addition and subtraction of fractions with like or unlike denominators. The fraction blocks were made of hard wood and were 1" × 2" × 8" in dimension. The blocks were cut into pieces to represent halves, thirds, fourths, fifths, sixths, eights, and tenths. Each student and the teacher had a set of fraction blocks.

Procedure

Pretest. The pretest was a concentrated probe in each area of computation of fractional numbers. The test consisted of four parts: addition, subtraction, multiplication, and division of fractions. Each part of the test contained 32 problems. The problems corresponded to the specific skills in each operation with fractions. In each section of the test, problems were arranged so that every four or five problems corresponded to each of the skills in a given operation. Since there were four skills to be mastered in addition, the first four consecutive problems in the addition test corresponded to the four skills in adding fractions. The test was arranged so that every four problems corresponded to the four addition skills. Students were allowed 40 minutes to complete the pretest.

General procedure. Five students participated in the evaluation of the math fractions program. Instructional periods were about 40 minutes long. All skills were taught in the Visual Response System classroom using transparencies and manipulatives. When a new skill was introduced: (1) the experimenter would explain and model the skill; (2) students practiced the skill using sample problems; and (3) the experimenter presented a transparency with 20 problems which incorporated the given skill. The students solved the problems for points. Music was played during problem solving allowing the teacher to remediate students individually. Students received two points for each problem solved correctly. These points were delivered when the students finished solving problems. A probe covering the specific skill being taught was administered at the end of each period. When at least three members of the class learned a skill, a new skill was introduced. After all skills were taught within an operation with fractions (e.g., addition), a unit probe was administered over all the operations with fractions. The unit probe was always given in the students' regular classroom.

Lottery tickets. Lottery tickets could be earned each day by the student based on their performance on the problems presented by the teacher. Lottery tickets were exchanged for every 10 points which a student earned. Students signed their lottery tickets and deposited them in a box that was provided by the experimenter. A record of the students' points was kept by the teacher. At the end of the week a drawing was held in which three winners were drawn. Winners could choose a soft drink or rock n' roll poster.

## Evaluation Procedure

Dependent variables. The dependent variables were: (1) each subject's percentage of problems solved correctly in each of the four operations: addition, subtraction, multiplication, and division; and (2) the correct and incorrect (error) rates of fraction problems completed per minute in each of the four operations. Eighteen specific types of fraction problems were used to measure performance.

Experimental design. A multiple probe design was used to evaluate the program's effectiveness. The multiple probe design is a variation of the multiple baseline design in which multiple baseline and probe procedures are combined (Horner and Baer, 1978).

Horner and Baer (1978) state that the multiple probe technique avoids the collection of continuous series of ritualistic baseline points when the performance of any component of a chain of behaviors or a sequence is impossible or very unlikely before aquisition of its preceeding component. Using the multiple probe design, an initial probe is given then training is applied. After every step of the training sequence, an additional probe is given. A probe is also conducted after criterion is reached on a training step. Therefore, a series of baseline sessions are conducted just before each new behavior is introduced to the independent variable.

In this study, a pretest was given before training was applied. After every step in the training sequence, an additional probe was given. This additional probe was called a daily probe. Another probe was given after criterion was reached on a training step. This probe was called a skill probe. A probe was also given after all skills within an operation were taught. This probe was called a unit probe. A posttest, or follow-up probe, was given four weeks after instruction in the Visual Response System.

## Results

Table 12 presents the results for percentage correct, rate correct, and rate incorrect for addition, subtraction, multiplication, and division of fractions.

Percentage correct. On the pretest, mean percentage correct in addition was 36.9% (range 8-92%). On the posttest, mean percentage correct was 94.2% (range 90-100%). Mean percentage correct in subtraction was 24.8% (range 0-62%) on the pretest. Mean percentage correct in subtraction was 91.8% (range 84-100%) on the posttest. Mean percentage correct on multiplication was 16% (range 3-48%) on the pretest. Mean percentage correct on multiplication was 68.2% (range 47-91%) on the posttest. Mean percentage correct in division was 0 on the pretest. Mean percentage correct in division was 74.2% (range 60-87%) on the posttest. Figure 9 shows percentage of correct answers of Student 3.

Rate correct. Mean rate correct in addition on the pretest was 1.1 problems per minute (range 0.2-2.4). Mean rate correct in addition on the posttest was 2.9 (range 1.5-3.0). Mean rate correct in subtraction on the pretest was 0.7 (range 0-1.8). Mean rate correct in subtraction on the posttest was 1.8 (range 0.7-3.2). Mean rate correct in multiplication of the pretest was 0.3 (range 0.1-1.0). Mean rate correct in multiplication on the posttest was 1.6 (range 0.9-2.4). Mean correct rate in division on the pretest was 0. Mean correct rate in division on the posttest was 1.4 (range 0.3-2.4). Figure 10 shows rate correct for Student 3.

Rate incorrect. Mean rate incorrect in addition on the pretest was 1.8 problems per minute (range 0.2-2.6). Mean rate incorrect on addition on the posttest was .2 (range 0-0.3). Mean rate incorrect in subtraction on the pretest was 2.3 (range 1.1-3.2). Mean rate incorrect in subtraction on the posttest was .2 (range 0-0.5). Mean rate incorrect in multiplication on the pretest was 2.1 (range 0.7-3.1). Mean rate incorrect in multiplication on the posttest was 0.8 (range 0.1-1.1). Mean rate incorrect in division on the pretest was 0.1 (range 0-0.3). Mean rate incorrect in division on the posttest was 0.5 (range 0.2-0.8). Figure 10 shows rate incorrect for Student 3.

Table 12. Percentage of problems solved correctly and rate correct and incorrect for addition, subtraction, multiplication, and division on the pretest and posttest for each student

| | Pretest | | | | Posttest | | | |
|---|---|---|---|---|---|---|---|---|
| | Add. | Sub. | Mult. | Div. | Add. | Sub. | Mult. | Div. |
| **Percentage Correct** | | | | | | | | |
| Student | | | | | | | | |
| 1 | 48 | 50 | 3 | 0 | 94 | 100 | 75 | 83 |
| 2 | 19 | 0 | 12 | 0 | 100 | 87 | 91 | 60 |
| 3 | 8 | 12 | 14 | 0 | 93 | 88 | 59 | 61 |
| 4 | 31 | 0 | 3 | 0 | 90 | 100 | 47 | 87 |
| 5 | 92 | 62 | 48 | 0 | 94 | 84 | 69 | 80 |
| $\bar{x}$ = | 36.9 | 24.8 | 16 | 0 | 94.2 | 91.8 | 68.2 | 74.2 |
| **Rate Correct** | | | | | | | | |
| Student | | | | | | | | |
| 1 | 1.5 | 1.4 | 0.1 | 0 | 3.0 | 3.2 | 2.4 | 2.4 |
| 2 | 0.6 | 0 | 0.1 | 0 | 1.5 | 0.7 | 1.0 | 0.3 |
| 3 | 0.2 | 0.4 | 0.1 | 0 | 2.7 | 1.5 | 1.6 | 1.1 |
| 4 | 1.0 | 0 | 0.1 | 0 | 2.7 | 1.8 | 0.9 | 1.4 |
| 5 | 2.4 | 1.8 | 1.0 | 0 | 3.0 | 2.7 | 2.2 | 2.1 |
| $\bar{x}$ = | 1.14 | 0.72 | 0.28 | 0 | 2.88 | 1.84 | 1.62 | 1.4 |
| **Rate Incorrect** | | | | | | | | |
| Student | | | | | | | | |
| 1 | 1.8 | 1.4 | 3.1 | 0 | 0.2 | 0 | 0.8 | 0.7 |
| 2 | 2.6 | 3.2 | 0.7 | 0.1 | 0 | 0.1 | 0.1 | 0.2 |
| 3 | 2.3 | 2.8 | 2.4 | 0 | 0.2 | 0.2 | 1.1 | 0.8 |
| 4 | 2.2 | 3.1 | 3.0 | 0.3 | 0.3 | 0 | 1.0 | 0.2 |
| 5 | 0.2 | 1.1 | 1.1 | 0 | 0.2 | 0.5 | 1.0 | 0.5 |
| $\bar{x}$ = | 1.82 | 2.32 | 2.06 | 0.08 | 0.18 | 0.16 | 0.8 | 0.48 |

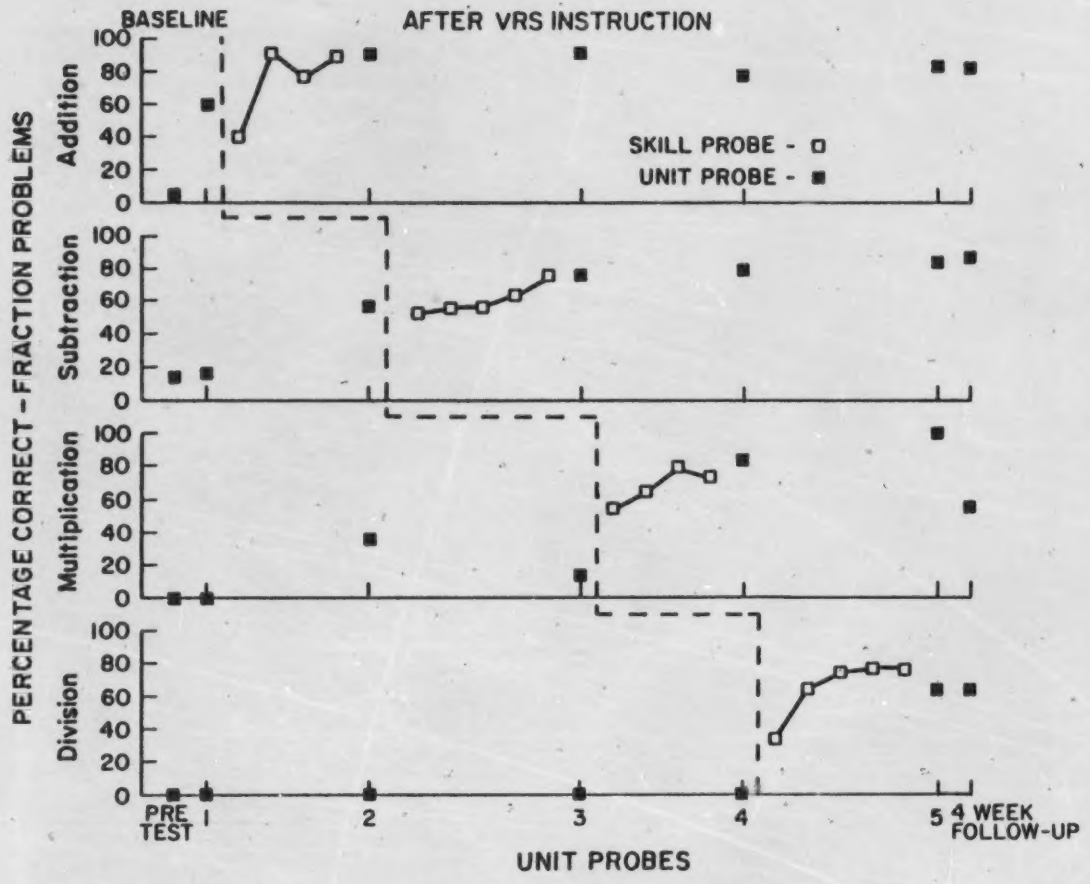




Fig. 9 - Percentage of fraction problems solved correctly as a function of Visual Response System instruction (Student 3)

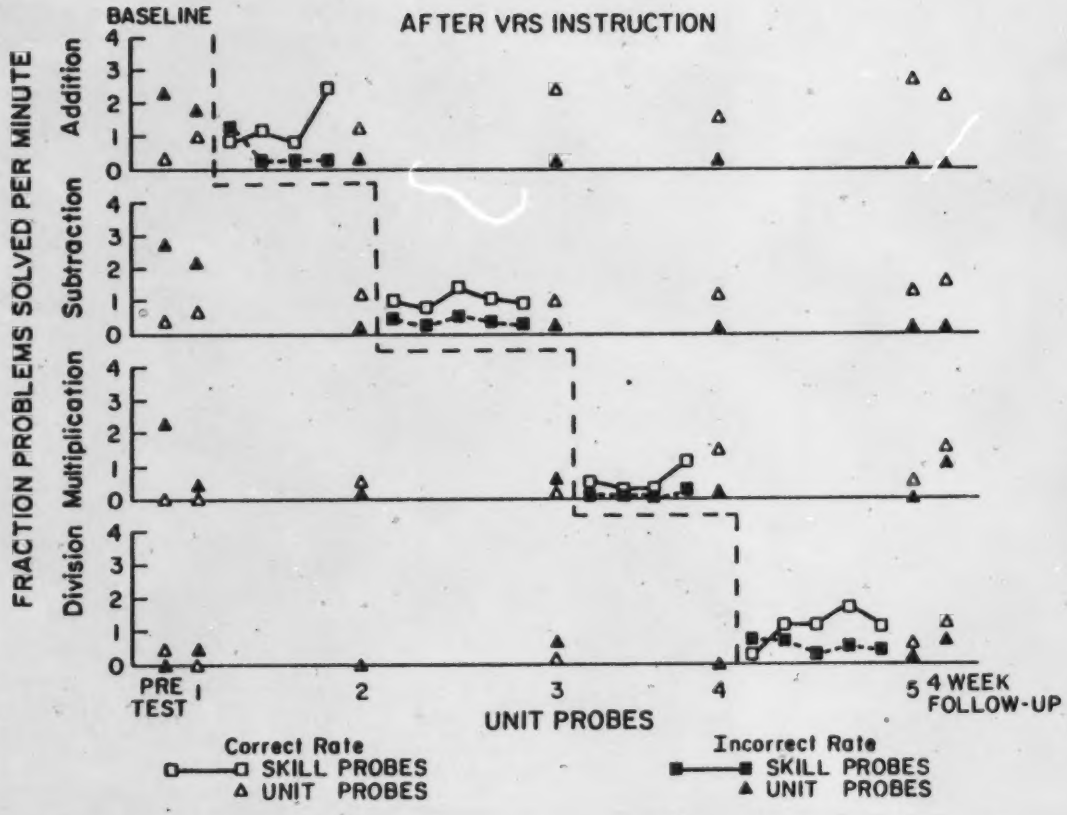


Fig. 10 - Correct and incorrect rate of solving fraction problems (Student 3)

## Discussion

Results of this study indicate that computation of math fractions can be taught in the Visual Response System. All five students increased the percentage of problems they solved correctly across all four operations. Rate correct for all students increased across all four operations, and rate incorrect decreased for all students across all operations except division. The probable explanation for the increase in rate incorrect is that students attempted more division problems on the posttest than on the pretest. Three students did not even attempt any division problems on the pretest.

Results indicate student performance increased on multiplication and division of fractions but not to an acceptable level. Plans are being developed for a continuation study to improve teaching these operations.

In general, the results indicate the Visual Response System to be an effective system of teaching mathematics. Further studies in math skills, such as simple addition, subtraction, multiplication, and division, co-ordinate geometry, and plane geometry, as well as comparative studies with the regular classroom, need to be conducted.

## Science: Photosynthesis

The development of a Visual Response System unit on photosynthesis was suggested by a science teacher at The Buckeye Youth Center. A set of sequenced skills was developed in conjunction with the science teacher and project staff developed the materials to teach each specific skill. The concept of photosynthesis was divided into four major areas, requiring students to: (1) write the three major parts of a green plant and state two functions of each part; (2) write the chemical symbols for the atoms and molecules in the photosynthesis equation, and, given the symbol for a compound, calculate and write the number of molecules and atoms in the compound; (3) write the photosynthesis cycle; and (4) write a definition of photosynthesis that includes seven distinct components (see Table 13).

## Procedure

Pretest. Students were given 20 minutes to complete the master test in a regular classroom setting. Subsequent administrations of the master test were given in the Visual Response System immediately following the completion of each part. Except for the follow-up tests, students received no feedback on their performance on the master test.

Teaching procedure. Although the specific teaching procedure was different for each of the four areas, the general procedure (see Appendix VII) followed a stimulus--student response--feedback model. Approximately 90% accuracy was required of each student during each step before proceding

Table 13. Target behaviors included in photosynthesis unit

---

I. Name the three major parts of a green plant and list two functions of each part. (9 points)
   1. Leaves
      a. absorb gases
      b. manufacture food for the plant
   2. Stem
      a. supports the plant
      b. conducts liquids up and down
   3. Roots
      a. absorb water
      b. absorb nutrients

II. Write the chemical symbols for the following chemical names. (9 points)
   1. Carbon dioxide = $CO_2$
   2. Water = $H_2O$
   3. Oxygen = $O_2$
   4. Hydrogen = H
   5. Carbon = C

   Answer the following: 8H SO equals
   6. 8 molecules
   7. 16 atoms of hydrogen
   8. 8 atoms sulfur(s)
   9. 32 atoms oxygen

III. Complete the photosynthesis cycle by filling in the blanks. (6 points)
   1. Man exhales carbon dioxide
   2. Plants take in carbon dioxide and water
   3. Plants make sugar (food) and oxygen
   4. Man breathes oxygen

IV. Write the definition of photosynthesis. (7 points)
   Photosynthesis is the process by which green plants take in carbon dioxide and water, and using energy from the sun, make food (sugar) and oxygen.

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to the next step. During some steps all student overhead projectors were "on" while students responded, and students were allowed to look at each others' responses. A total of five 40-minute instructional sessions was required to complete instruction on all four areas.

Points earned by each student were exchanged for cigarettes or lottery tickets (20 points = 1 ticket or 1 cigarette). Lottery tickets were drawn at the end of the photosynthesis unit, until three winners had been selected. Winners could choose either a soft drink or a rock 'n roll poster.

Three-week and six-week follow-up. Three weeks (13 school days) after the photosynthesis unit was completed, the students were asked to complete the master test. Feedback, in the form of returning the graded test was given to each student within one week following this test. Six weeks after the photosynthesis unit was completed the students were again asked to complete the master test. The six-week follow-up test was conducted with only three students; the remaining four students were no longer at the correctional facility.

Interobserver reliability. A second, independent observer graded all of the master tests completed by the students throughout the study. Reliability was computed by dividing the number of questions on which both graders agreed by the total number of questions attempted and multiplying by 100. Reliability on the pretest was 96.3%. Reliability was 97, 99.5, 98.4, and 99%, on the tests given after instruction on each of the four areas. Reliability was 98.6 and 100% on the three-week and the six-week follow-up tests respectively.

## Materials

Teacher Overhead Transparencies. Teacher Overhead Transparencies were used to present new concepts to the students. Information was presented using overlays, masking, and progressive disclosure. All Teacher Overhead Transparencies required the students to respond in some way to the information presented by the transparency.

Student Response Slides. Student Response Slides are 3 x 3" acetate slides which contain single words or phrases. Students were required to place on their overhead projectors response slides containing the correct answers to questions or problems presented by the Teacher Overhead Transparencies. Student Response Slides were used to identify the three parts of a green plant, two functions of each part, and the photosynthesis cycle.

Student Response Transparencies. Student Response Transparencies were divided equally into six numbered sections. Students either wrote answers or placed response slides in the numbered sections of the response transparency as directed by the teacher. Student Response Transparencies resulted in each student organizing his responses the same way on the overhead projector, making it easy for the teacher to quickly scan the projected responses and provide feedback as appropriate.

Atom Transparencies. Atom Transparencies were 1" circles of transparent acetate with the letter H (hydrogen), C (carbon), or O (oxygen) written on them.

## Evaluation Procedure

Throughout the study target behaviors were measured by recording students' responses on a written test requiring a total of 31 responses. A multiple-baseline-across-behaviors design was used to evaluate the effectiveness of the instructional program. Each of the four areas of photosynthesis was taught in succession. Each time the instructional program was completed for a set of items, the students were administered the test. Data from the students' performance each time they completed the test were used in the multiple baseline analysis.

## Results

Mean performance of the seven students is presented because it is representative of each student's behavior, except for Student 1 who answered six of nine questions correctly on part two on the pretest, and remained at this level throughout the study. Student 1 was absent the day part two was taught. Students averaged 6.3 (range 0-11) questions correct on the pretest, 29.5 (range 24-31) correct on the probe following instruction on all four areas, 25.4 (range 13-31) correct on the three-week follow-up, and 27.3 (range 21-31) correct on the six-week follow-up.

Figure 11 shows the average number of questions completed correctly by each of the seven students on the master test across the four areas.

## Discussion

Results of this study show the instructional program was effective in teaching juvenile offenders basic principles of photosynthesis. After instruction on all four areas, two students answered all 31 questions correctly, three students completed 30 questions correctly, one student completed 28 questions correctly, and Student 1 answered 24 items correctly. One factor that may have worked to keep Student 1's score low is the fact that he did not receive instruction, due to absence, on the second set of items--atoms and molecules. Although his pretest score was six of nine questions correct, these answers were on writing the symbols for different chemicals. Student 1 was not able to calculate the number of atoms and molecules in a compound on the pretest. Student 1's performance on the other three areas increased after instruction. The fact that Student 1's performance on the second area did not increase (since he was absent during training), lends support to the effectiveness of the instructional package.

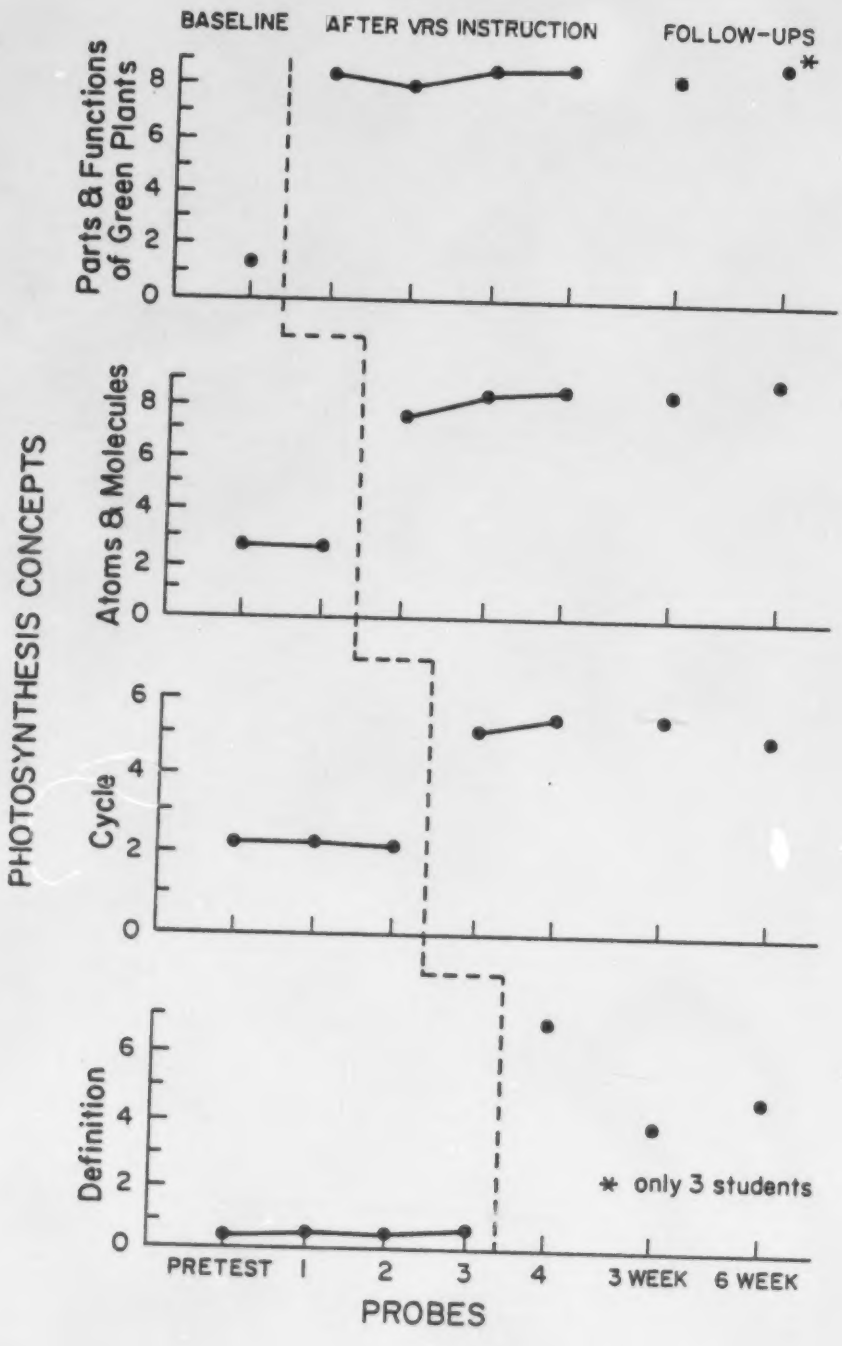


Fig. 11 - Mean number of correct answers on photosynthesis pre-posttest and probes

The technology provided by the Visual Response System (VRS) allowed the teacher to incorporate at least four positive features into the program. First, high rates of student response were maintained during the program. Schery (1975) has pointed out the importance of active student participation in teaching science to low-achieving students. Hall, Delquadi, and Harris (1978) have noted that a major difference between inner-city children who are academically behind their suburban peers is that inner-city classrooms, as a rule, provide students with very little opportunity to actively engage in the skills they are supposed to learn. In several studies, Hall and his colleagues found that simply increasing a student's opportunity to respond often resulted in academic gains. They write, "we...should...find systems which will allow pupils to increase their responding which will not be punishing to the teacher because of the heavy workload they might impose" (p. 23).

In this study, the average number of responses per student during a 40-minute period were 55, 25, 18, and 25 for the four parts of the photosynthesis unit. (Differences in the number of responses made by each student across the four parts of the program are a function of the different content and procedures used in each of the parts.) This rate of student response was accomplished in a small group setting, meaning that a total of 385 individual student responses were emitted and received feedback during the session on green plants. Use of Student Response Slides in certain parts of the program was partly responsible for the high student response rate. Instead of writing out answers, a student only had to place a response slide on the stage of his overhead projector.

The second positive feature of the program was that each student response received feedback almost immediately. The teacher only had to scan the projected responses to get visual access to each student's work. Use of the Student Response Transparencies meant that when students emitted responses to a series of questions, each student arranged his responses in the same format. This enabled the teacher to locate quickly a student's response to each particular question. To reinforce correct responses, the teacher simply had to move a toggle switch on the teacher's console, advancing the student's counter. After all students had responded, the teacher projected the correct response, which provided remedial feedback to students who had errored.

Third, the Visual Response System enabled a variety of response topographies to be incorporated into the program. Esler, Midgett, and Bird (1977) recommended employing manipulative materials when teaching science concepts to exceptional students. In the part on atoms and molecules, each student constructed directly on the stage of his overhead projector molecules from individual Atom Transparencies. This exercise helped the students to experience a concrete dimension of a concept that previously had been entirely abstract, to determine the composition of the molecule in photosynthesis, and to help conceptualize the chemical equation of photosynthesis.

Finally, because the students could see each others' responses when the overhead projectors were "on," they were able to use their classmates' correct responses as models. This student-student interaction made possible by the Visual Response System may have resulted in feedback directed toward one student serving as a functional consequence for other students. On numerous occasions a student, who had committed an error similar to one made by a peer, would self-correct his response after he had seen the teacher remediate his peer's work.

Results of the two follow-up tests show the students not only maintained the knowledge they had acquired about photosynthesis, but that generalization from the Visual Response System to the regular classroom had occurred.

Students were administered a questionnaire about the program after the three-week follow-up test. All seven students reacted very positively to the Visual Response System in general and to the photosynthesis unit in particular. Students stated that they enjoyed being "right" so often (all students responded with over 95% accuracy during the instructional sessions) and one student said that the Visual Response System made it possible for students who did not know an answer to learn from him if his response was correct and vice versa.

In summary, the program enabled the students to learn the basic principles of photosynthesis in five 40-minute sessions. No research on teaching photosynthesis could be found in the literature. Consequently no comparisons can be made between teaching this concept in the Visual Response System and in the regular classroom. However, science teachers at the school where this research was conducted felt it would take at least two weeks to teach the same concepts in the regular classroom, and they doubted students would do as well. Results of the present study seem to indicate that the Visual Response System, which enables all students to actively respond in a variety of ways, is an effective environment in which to teach science concepts.

## Self-Management

A Visual Response System program was developed to teach self-management skills to adolescent juvenile delinquents. It was hoped that by providing such subjects with methods of controlling their own behavior, it might alleviate the need for external control by the judicial system.

After reviewing a number of previous studies on teaching self-management to various populations, a curriculum was developed that roughly approximates that used by Hall (1976) in teaching undergraduate physical education students. Several changes were made to adjust the curriculum to the subjects to be taught in this study. The instructional topics were broken down into smaller units and some terms were changed to simpler and more concrete alternative terms.

This curriculum was adapted for use in the Visual Response System by presenting all instructional materials in visual form, on transparencies. Also, opportunity for frequent student response was built into every lesson.

The objectives of this program were: (1) to increase students' verbal knowledge of self-management principles; and (2) to aid them in conducting successful self-management projects on selected behaviors of their own. Students' evaluations of the course and the Visual Response System setting were obtained. A pre-post measure of locus of control was administered to determine if completion of the course would affect the students' perception of the degree to which they controlled their own lives. Attendance was also monitored.

## Procedure

The curriculum consisted of 16 units, each covering one component of self-management. The entire program required 13 class meetings. The 16 units were:

1. Introduction to the Visual Response System
2. Introduction to the Self-Management Course
3. Selecting Target Behaviors
4. Defining Target Behaviors
5. Measuring Target Behaviors
6. Recording Target Behaviors
7. Review of Defining, Measuring, and Recording Behavior
8. Baseline
9. Graphing Target Behaviors
10. Rewards
11. Relief Rewards (Negative Reinforcement)
12. Interobserver Agreement
13. Punishers
14. Tokens
15. Rewarding Less Often (Intermittent Reinforcement)
16. Review of Rewards, Relief Rewards, and Punishers

Students were awarded points for answering questions in class correctly, for recording their own behavior, and for graphing their target behaviors correctly. The student with the largest number of points earned at the end of a class session was permitted to select the taped music to be played during the next session.

During the program, students were given 10 homework assignments. Those students who completed 8 or more of these assignments were permitted to go on a bowling trip at the end of the program. These 10 assignments were:

1. Select target behavior
2. Define target behavior
3. Measure target behavior
4. Keep a record of target behavior
5. Graph target behavior
6. Select a reward for reaching criterion
7. Implement this reward
8. Obtain an interobserver reliability check
9. In-class presentation of project
10. Take posttest

All students conducted self-management projects as a part of this course. These projects consisted of selecting a target behavior, defining it, then taking a baseline measurement on it prior to implementing an intervention. Intervention consisted of presenting a reward contingent upon meeting a self-determined criteria. The rewards were given out by the experimenter, due to institutional rules against students possessing quantities of consumables, but in all cases, students were given the sole responsibility of determining whether they had earned this reward. See Appendix VIII for a description of the general instructional procedure.

## Materials

The following materials were used in this study:

1. Student consent forms
2. Student contracts for completion of course requirements
3. Pretest of self-management principles

4. Posttest of self-management principles (see Appendix VIII)

5. Nowicki-Strickland Locus of Control Scale

6. Ninety experimenter-made instructional transparencies covering the principles of behavior management in 16 topics (see Appendix VIII)

7. Student response transparencies

   a. Sixteen blank write-on transparencies

   b. Eight sets of "Timing" and "Counting" slides

   c. Eight recording form transparencies

   d. Eight simple graph transparencies

   e. Sixteen advanced graph transparencies

   f. Eight reward specification transparencies

   g. Eight sets of "Yes" and "No" slides

8. Eight cardboard folders

9. Non-permanent transparency marking pens

10. Homework assignment sheets

    a. Target behavior definition forms for specifying the behavior to be changed in the project

    b. Recording forms for data on target behavior

    c. Graph forms

    d. Reward specification forms

    e. Overt interobserver report forms

    f. Punishment specification forms

11. Rewards used in student projects

    a. Cans of soft drinks

    b. Candy bars

    c. Small boxes of raisins

    d. Notes to youth leaders

12. Covert staff interobserver forms

13. Student Evaluation of Course and Visual Response System

The instructional transparencies were directed towards occasioning active student response, while still giving sufficient explanation of new concepts. An effort was made to make these transparencies as high in interest value as possible, often incorporating color, pictures, and humor.

Most student responses made during class required only blank write-on transparencies. However, recording and graphing transparencies were used at the beginning of the later sessions for students to present the new data on their projects. Other specialized student response transparencies were developed to meet the needs of the particular lesson.

Evaluation

Verbal knowledge of behavioral principles was measured by pre-posttest scores. There were a variety of item types, including multiple choice, true-false, short essay, graphing responses, and recording responses. Items covered all topics instructed and were similar to the questions asked on unit quizzes. In analyzing the scores, total scores were calculated as well as scores on items concerning each of the unit topics.

In evaluating the self-management projects, primary emphasis was placed on completing the assignments scientifically and accurately rather than successfully. There were a total of 20 possible points. The criteria required that the target behavior be relevant to the goals of the correctional institution and that behavior be defined observably and specifically. The target behavior was to be measured using an appropriate method and recorded without missing more than two days. Points were given for graphing the target behavior, correct labeling, plotting, distinction between baseline and intervention, and proper connection of data points. The rewards selected were to be practical and appropriate in quantity. The standards for rewards were judged suitable if student behavior changed in the desired direction. Points were given for attempting to obtain an interobserver reliability check, for computing the percentage correctly, and for obtaining 80% agreement or better. Finally, projects were judged upon success in changing the target behavior, as indicated by both the data and the students' expressed opinions on the evaluation of the course.

The Nowicki-Strickland Locus of Control Scale, abbreviated for grades 1-6, was used as the pre- post measure of locus of control. The scale was administered in printed form. Three scores were figured for each subject: total score, score on all items except those concerning control over home situations, and score on one question that was particularly relevant to the school situation.

Students' evaluations of the course and the Visual Response System were assessed through an experimenter-devised questionnaire administered

at the end of the course. Students could indicate strong agreement, moderate agreement, moderate disagreement, or strong disagreement with each of eight statements.

Daily attendance logs were kept on each student. Total average attendance and individual average attendance data were computed.

## Results

Scores on students' self-management project ranged from 12 to 19 points, with a mean of 15.75, out of a possible 20, (see Table 14). All student data showed a change in the desired direction in their target behaviors.

Student 1 decreased his verbal interruptions of others' conversations from a mean of 15.9 during baseline to a mean of 4.6 per day during intervention (see Fig. 12). Raisins and candy bars were used as rewards. One-hundred percent agreement with a selected overt interobserver was achieved.

Student 2 increased his minutes worked in class from a mean of 22.8 minutes during baseline to a mean of 41.7 minutes during intervention, using one can of soft drink per day as the reward (see Fig. 13). No interobserver reliability check was obtained.

Student 3 increased his mean daily pushups from 135.7 during baseline to 257.8 during intervention (see Fig. 14). A can of soft drink per day was used as a reward. One-hundred percent agreement with an overt interobserver was achieved.

Student 4 chose to decrease his daily use of swear words (see Fig. 15). Use was decreased from an initial baseline of 18.4 words per day, to a mean of 11.5 words per day during intervention. One-hundred percent agreement with an overt interobserver was achieved.

Student 5 selected decreasing the number of fights as his target behavior (see Fig. 16). Fighting was decreased from a mean of .27 per day during baseline to 0 during intervention. A can of soft drink per day was used as reward. One-hundred percent agreement with an overt interobserver was achieved.

Student 6 decreased his use of swear words from a mean of 20.8 per day during baseline to a mean of 11.9 per day during intervention (see Fig. 17). A note of recommendation to his youth leader was used as a reward. No overt interobserver reliability check was attained.

Student 7 chose to work on increasing the number of pushups and situps he did per day (see Fig. 18). His behavior increased from a mean of 47.1 of each exercise per day during baseline to a mean of 90.8 of each during intervention. A can of soft drink per day was used as a reward.

Table 14. Scores on Evaluation of Student Self-Management Projects

| Topic | Target Beh. | Definition | | Measuring | | Recording | Graphing | | | | | Consequences | | | | Interobserver | | | Results | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Student | Relevant to instructional goals | Observable | Specific | Rating or Counting | Recommended Procedure | Record 2 or More Days | Days Labeled | Behavior Labeled | Plotted Correctly | Baseline | Connect points correctly | Practical | Appropriate Goals | Initial Criterion | 2 Increases or more | Attempted | Completed Correctly | 80% or better | Graph | Questionnaire | |
| 1 | + | + | 0 | + | + | + | + | 0 | + | + | + | + | + | + | 0 | + | + | + | + | + | 17 |
| 2 | + | 0 | 0 | + | + | + | + | + | + | + | + | + | + | 0 | 0 | 0 | 0 | 0 | + | 0 | 12 |
| 3 | 0 | 0 | 0 | + | + | + | + | + | 0 | + | + | + | + | + | + | + | 0 | + | + | + | 15 |
| 4 | + | + | + | + | 0 | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 19 |
| 5 | + | + | 0 | + | + | + | + | 0 | + | + | + | + | + | + | 0 | + | 0 | + | + | + | 16 |
| 6 | + | + | + | + | 0 | + | + | 0 | + | + | + | + | + | + | 0 | 0 | 0 | 0 | + | + | 14 |
| 7 | 0 | 0 | 0 | + | + | + | + | 0 | + | + | + | + | + | + | + | + | + | + | + | + | 16 |
| 8 | + | + | 0 | + | + | + | + | + | + | + | 0 | + | + | + | 0 | + | + | + | + | + | 17 |
| Percent Receiving Credit | 75 | 62.5 | 25 | 100 | 75 | 100 | 100 | 50 | 87.5 | 100 | 87.5 | 100 | 100 | 87.5 | 37.5 | 75 | 50 | 75 | 100 | 87.5 | |
| Percent by Topic | 75 | 43.75 | | 87.5 | | 100 | 85 | | | | | 93.75 | | | | 66.7 | | | 93.75 | | |

+ = met criterion

0 = did not meet criterion

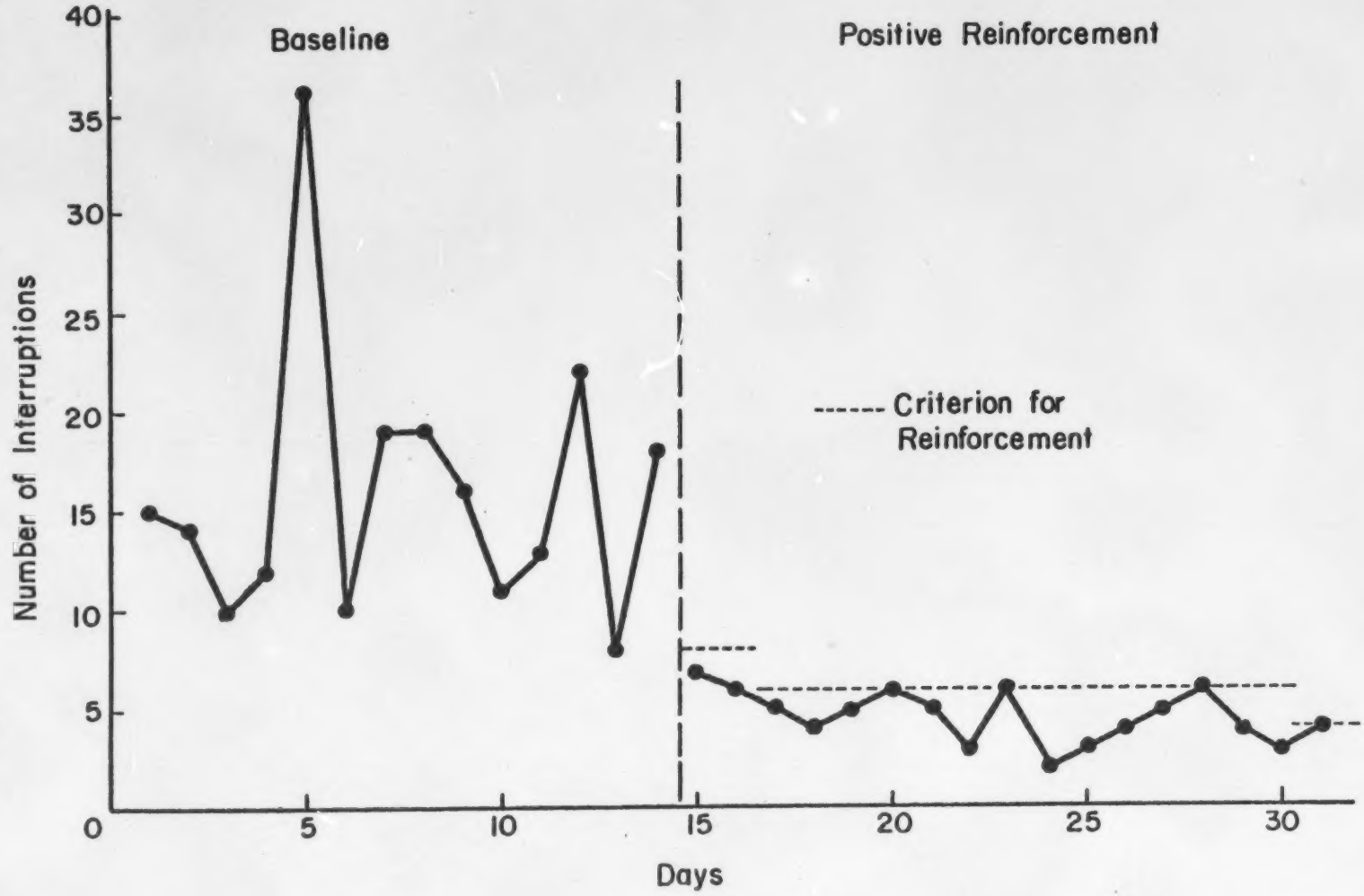


Fig. 12 - Number of verbal interruptions during baseline and self-administered reinforcement (Student 1)

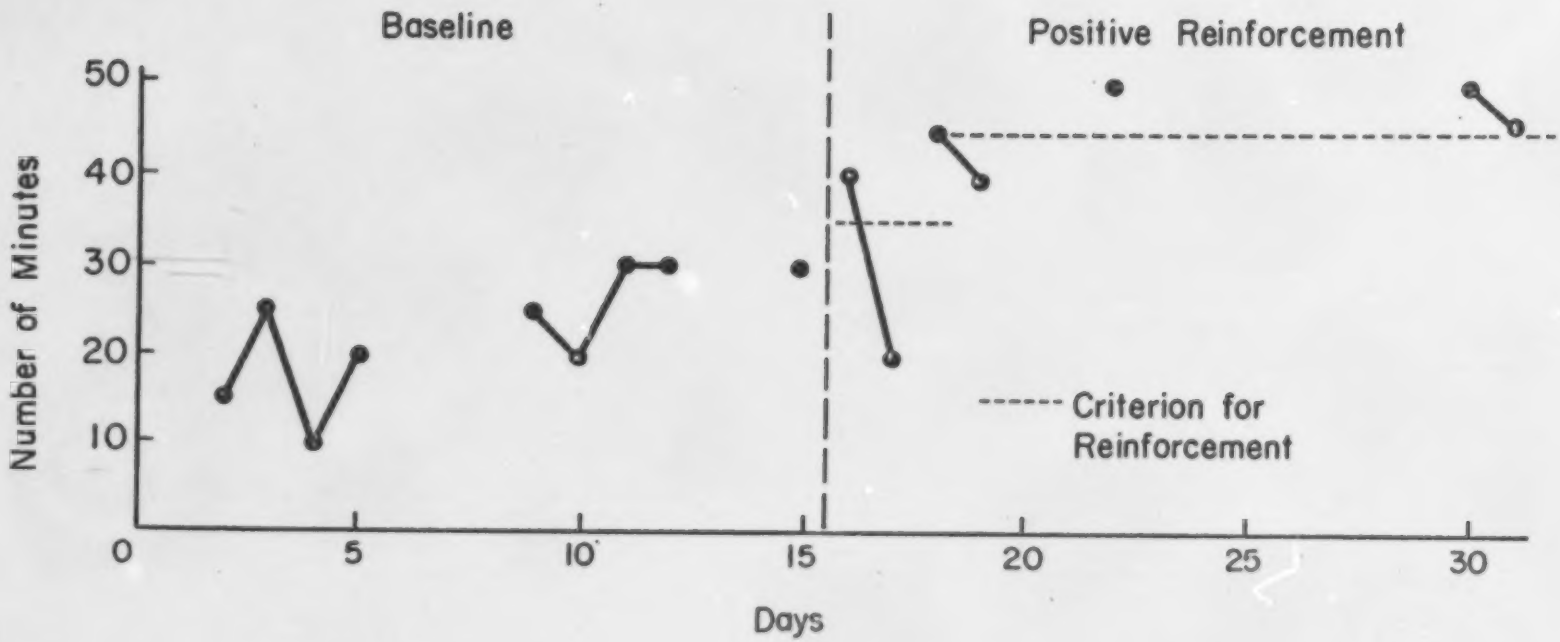


Fig. 13 - Number of minutes worked in class during baseline and self-administered reinforcement (Student 2)

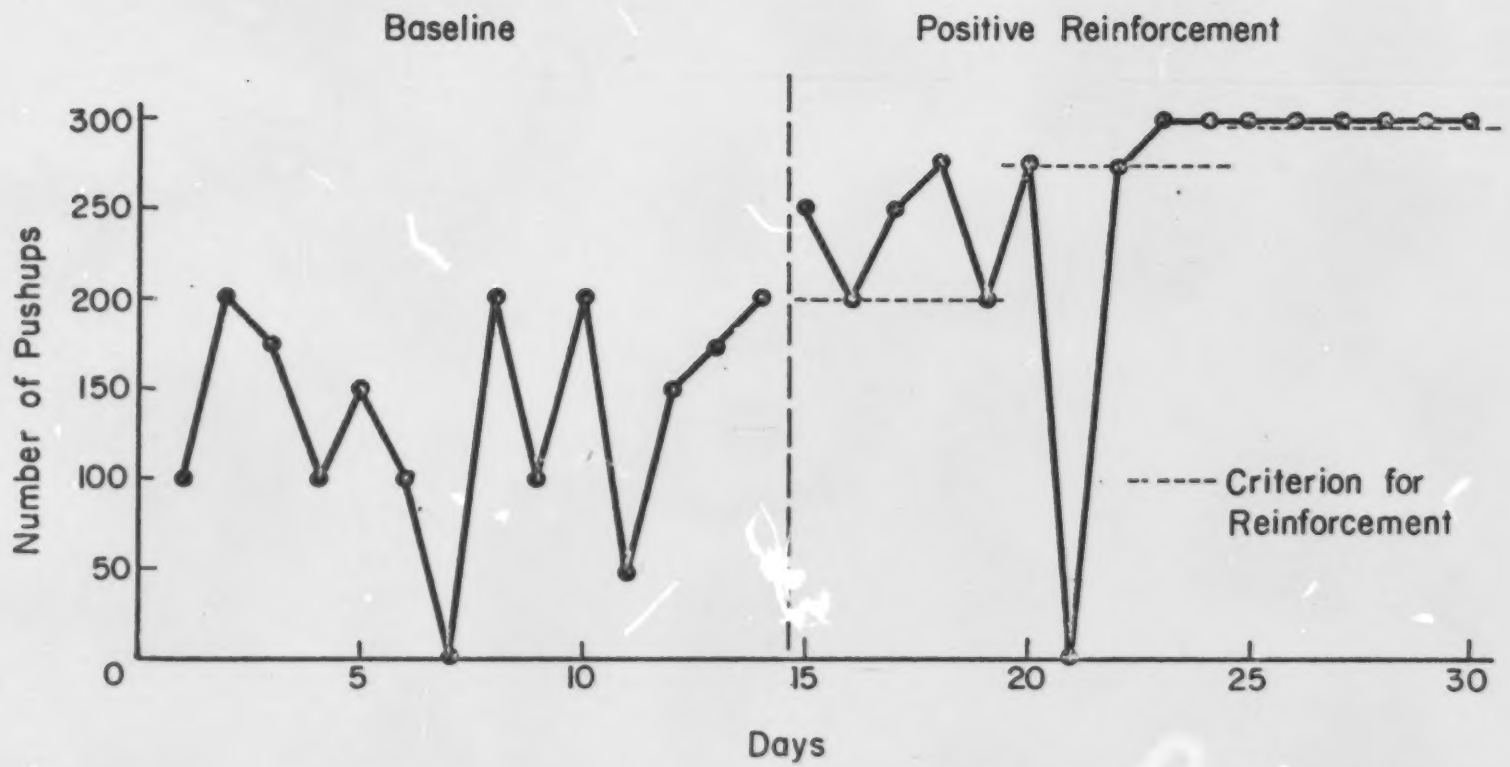


Fig. 14 - Number of daily pushups during baseline and self-administered reinforcement (Student 3)

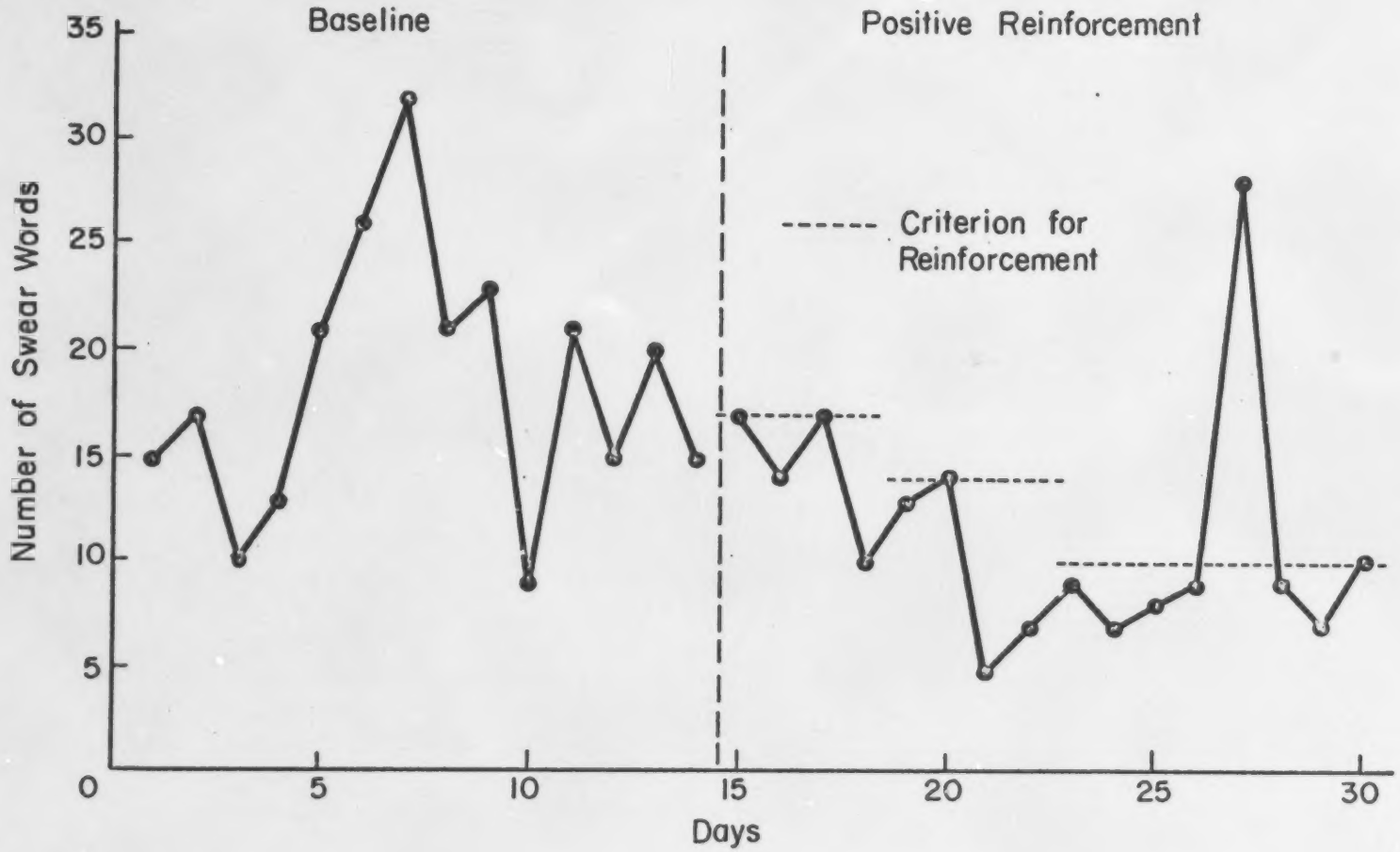


Fig. 15 - Number of swear words emitted per day during baseline and self-administered reinforcement (Student 4)

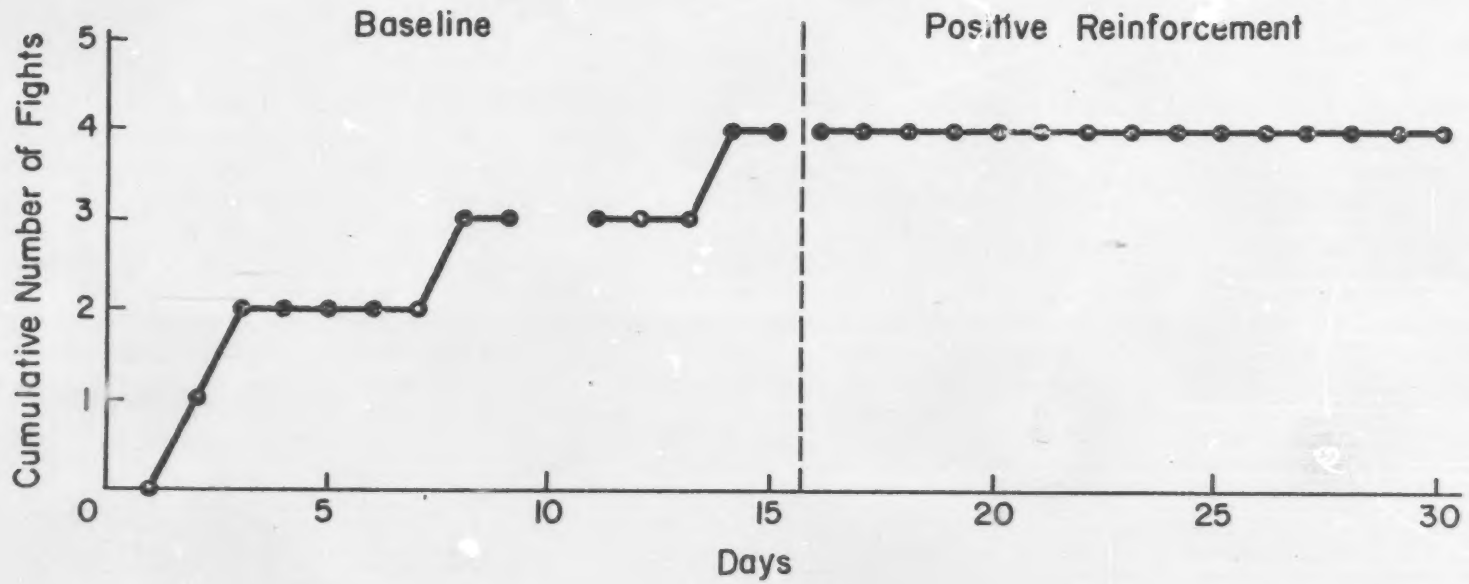


Fig. 16 - Cumulative number of fights during baseline and self-administered reinforcement (Student 5)

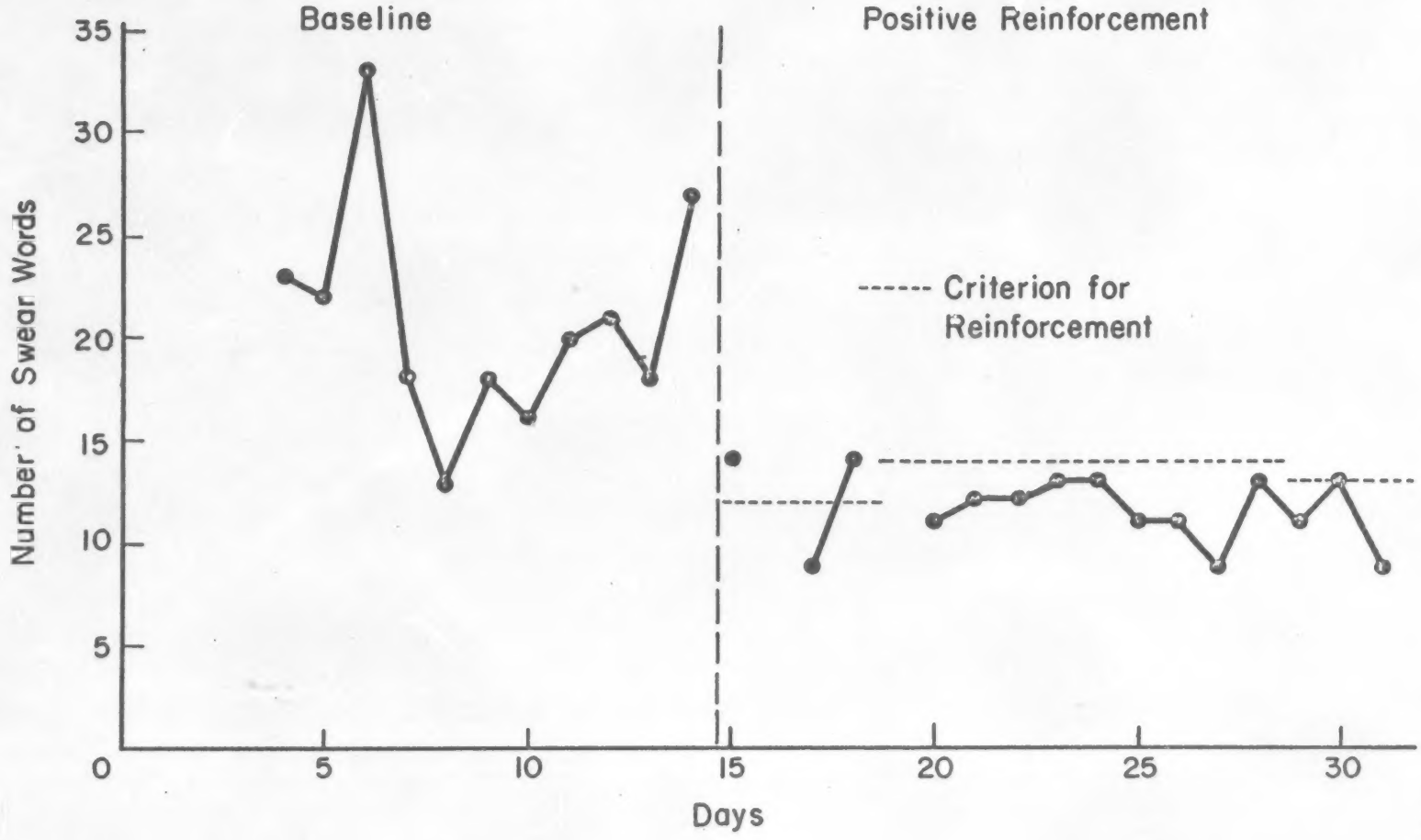


Fig. 17 - Number of swear words emitted per day during baseline and self-administered reinforcement (Student 6)

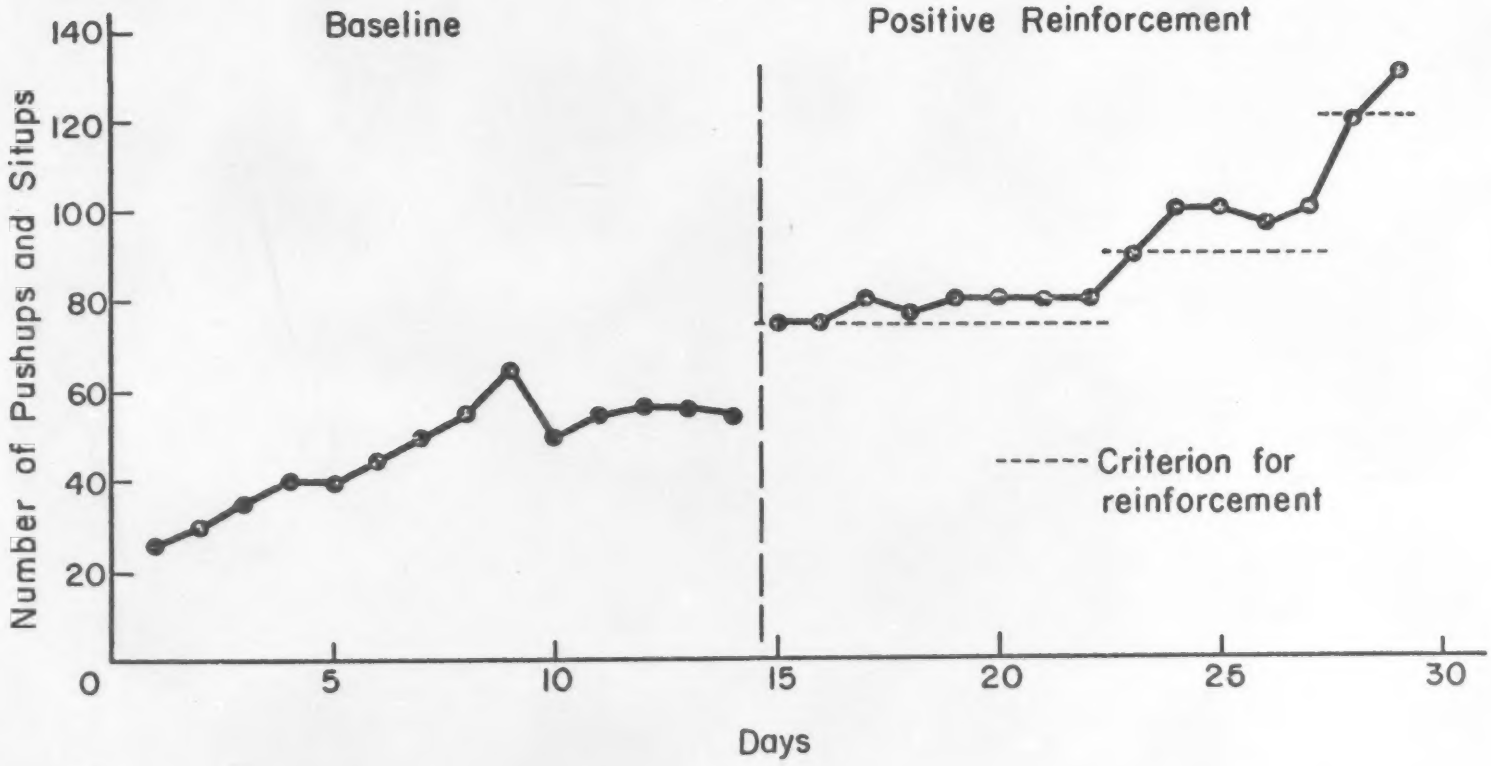


Fig. 18 - Number of daily pushups and situps during baseline and self-administered reinforcement (Student 7)

Student 8 increased the number of letters written for job applications from 0 per day during baseline to a mean of 1.4 letters a day during intervention (see Fig. 19). Two small candy bars per day were used as a reward. One-hundred percent agreement with an overt interobserver was achieved.

All students' scores on the test of verbal knowledge of self-management principles increased from pre- to posttest (see Table 15). Mean scores on each topic covered in the test also increased. Mean total score increased from 35.6% correct on the pretest to 80.7% correct on the posttest (see Table 16). Mean change in score was 45.1% with a range of 13.7 to 67.5% change.

Results of the locus of control scale were analyzed by the percentage of internal responses to items referring to home situations versus other situations as well as total scores. Scores on Question 17, which referred specifically to a school situation, were also separated from the total score for analysis. Mean total score increased 5.2% from the pre- to posttest, with one student's total score actually decreasing. When separated into home and other situation scores, it was found that the mean "home" score decreased slightly from the pre- to posttest, although three students' scores did increase. Mean percentage of internal response to "other" situations increased 11.2% from the pre- to post-measure. On Question 17, 5 out of 8 students responded internally on the pre-measure while 6 out of 7 available responded internally on the post-measure for an increase of 62.5 to 85.7 in percentage of internal responses. However, the one student who responded externally on the post-measure had responded internally on the previous measure.

Table 17 shows the results of student evaluation forms. Students could indicate strong disagreement to strong agreement with each statement by circling a number from 1-4, respectively. The mean rating given by the students was 3.49, with a range of 4.0 to 3.13. Mean ratings of the 8 items ranged from 3.1 on Item 6, to 3.7 on Item 2, with one student omitting this response. Seven out of eight students indicated on Item 8 that they felt they had changed their behaviors with the methods they had learned, with six of seven students strongly agreeing with the statement.

Average attendance for the students was 82.7% of the 13 sessions, with a range from 61.5% to 100% for individual students. There was only one unexcused absence.

## Discussion

All students completed their self-management projects and all obtained changes in their target behaviors. Every student's score on the test of verbal knowledge of behavioral principles increased from pre- to posttest. Changes in the target behaviors were also noted informally by the residential staff, although formal covert interobserver data were difficult to obtain. Overt interobserver reliability checks resulted in high percentages of agreement.

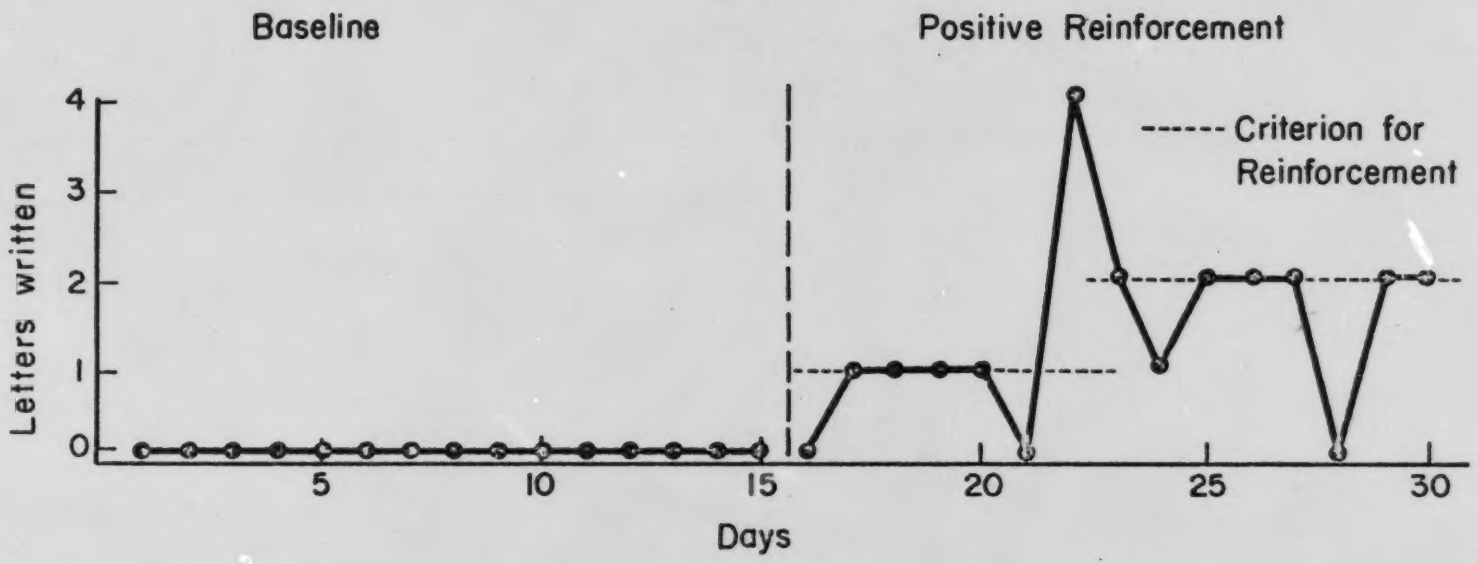


Fig. 19 - Number of letters of application written during baseline and self-administered reinforcement (Student 8)

Table 15. Student Scores on Pre-Posttest of Self-Management Principles, Divided by Topic

| Topics / Students | Def. 1 Possible | | Measure 4 Possible | | Recording 1 Poss. on Pre 3 Poss. on Post | | Baseline 2 Possible | | Graph 3 Possible | | Reward 6 Possible | | Belief Reward 4 Possible | | Inter-observer 2 Possible | | Punishment 2 Possible | | Tokens 6 Possible | | Intermit. Rewards 2 Possible | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. | a. | b. |
| 1 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 2 | 0 | 2 | 2 | 6 | 3 | 4 | 0 | 1 | 0 | 2 | 0 | 5 | 0 | 1 | 5 | 29 |
| 2 | 0 | 0 | 0 | 4 | 0 | 3 | 0 | 2 | 0 | 2 | 3 | 6 | 3 | 4 | 0 | 1 | 2 | 2 | 1 | 5 | 0 | 1 | 9 | 30 |
| 3 | 0 | 0 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 3 | 6 | 6 | 4 | 4 | 0 | 2 | 2 | 2 | 1 | 3 | 0 | 0 | 20 | 26 |
| 4 | 0 | 0 | 2 | 4 | 0 | 2 | 0 | 2 | 0 | 3 | 4 | 6 | 3 | 3 | 0 | 2 | 0 | 1 | 0 | 6 | 0 | 2 | 9 | 31 |
| 5 | 0 | 0 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 2 | 5 | 6 | 0 | 3 | 0 | 1 | 2 | 2 | 2 | 6 | 0 | 0 | 13 | 27 |
| 6 | 1 | 1 | 0 | 4 | 0 | 2 | 1 | 1 | 0 | 2 | 6 | 5 | 4 | 4 | 0 | 1 | 0 | 0 | 1 | 6 | 0 | 0 | 13 | 26 |
| 7 | 0 | 1 | 4 | 4 | 0 | 1 | 0 | 2 | 0 | 3 | 6 | 6 | 4 | 4 | 1 | 2 | 2 | 2 | 1 | 6 | 1 | 2 | 19 | 33 |
| 8 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 1 | 0 | 3 | 5 | 6 | 1 | 4 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 6 | 25 |
| Mean | .13 | .25 | 1.75 | 4 | .13 | 1.38 | .25 | 1.38 | .13 | 2.5 | 4.63 | 5.88 | 2.75 | 3.38 | .13 | 1.25 | 1 | 1.63 | .75 | 5.13 | .13 | .75 | 11.75 | 28.38 |

Table 16. Total Scores on Pre-Posttest of Self-Management Principles

| | Pretest 33 Possible | | Posttest 35 Possible | | Change From Pre- to Posttest | |
|---|---|---|---|---|---|---|
| Student | # correct | % correct | # correct | % correct | # | % |
| 1 | 5 | 15.2 | 29 | 82.9 | 24 | 67.7 |
| 2 | 9 | 27.3 | 30 | 85.7 | 21 | 58.4 |
| 3 | 20 | 60.6 | 26 | 74.3 | 6 | 13.7 |
| 4 | 9 | 27.3 | 31 | 88.6 | 22 | 61.3 |
| 5 | 13 | 39.4 | 26 | 74.3 | 13 | 34.9 |
| 6 | 13 | 39.4 | 26 | 74.3 | 13 | 34.9 |
| 7 | 19 | 57.6 | 33 | 94.3 | 14 | 36.7 |
| 8 | 6 | 18.2 | 25 | 71.4 | 19 | 53.3 |
| Mean | 11.8 | 35.6 | 28.3 | 80.7 | 16.5 | 45.1 |

Table 17. Responses to Student Evaluation Forms

| | Looked forward to class | Liked using VRS equipment | Class was interesting | Methods learned are useful | Learned a lot | Will use methods in the future | Would suggest class to friends | Changed target behavior | |
|---|---|---|---|---|---|---|---|---|---|
| Question # / Students | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Mean |
| 1 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3.88 |
| 2 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3.25 |
| 3 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3.13 |
| 4 | 4 | 4 | 3 | 4 | 3 | 2 | 4 | 4 | 3.5 |
| 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4.0 |
| 6 | 3 | | 4 | 3 | 4 | 3 | 3 | 4 | 3.43 |
| 7 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 4 | 3.13 |
| 8 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3.63 |
| Mean | 3.63 | 3.71 | 3.5 | 3.63 | 3.5 | 3.13 | 3.25 | 3.63 | 3.49 |

Percentage of "internal" responses to a locus of control scale changed only slightly during the study. Although there was a slight general increase in internal responses, one student's responses actually became more external from pre- to posttest.

There were several advantages in conducting the self-management class in the Visual Response System classroom. All students responded to every question and the student-student interaction provided by the Visual Response System may have enabled students to learn from one another's responses. The large visual display made it easy for students to draw their graphs for the teacher to examine. The sound system provided an additional means of reinforcement and remediation. The novelty of the situation may have also contributed to the students' interest.

Extending the length of the course would allow several improvements to be made in the curriculum. The topic of defining target behaviors could be dealt with in more depth, as this was the topic least understood by the students. Time should also be available to allow students to use punishments and intermittent reinforcement prior to discontinuing their projects. Covert post-checks would provide information on the durability of any changes accomplished during the course.

Several aspects of this study merit more in-depth research or modification:

1. A more rigorous covert interobserver check of student data would reveal the accuracy of student recording. In order to obtain reliable interobserver data, observers should be carefully selected and trained.

2. Reliability checks could be obtained, both overtly and covertly, to compare these sets of data points to determine the extent of influence that knowledge of being observed has upon the target behavior.

3. Social workers employed by correctional facilities could be trained in self-management techniques and be given the responsibility of teaching these methods to their students.

4. A control-group design could be arranged in which students working on the same target behavior could be divided into two conditions; those receiving the self-management training and those simply instructed to attempt to change the behavior in any way they could.

5. A study could be conducted to see if there is any difference in recidivism rates among those students receiving self-management training as opposed to those not receiving it.

## Student-Student Interaction

A basic research study was conducted on student-student interaction in the Visual Response System. Student-student interaction in the Visual Response System has been noted informally (Eachus, 1969; Heward, 1974b). For example, in a sentence writing lesson if the word purple appeared as an adjective in the sentence of a student, the word purple would begin to appear in subsequent sentences of other students. This study sought to determine the amount of student-student interaction that occurs in the Visual Response System in a language arts activity. The basic experimental design involved comparing the extent of student-student interaction on days when students performed a writing task with their overhead projectors "on" with their performance of the same task on days when their projectors were "off." With the student overhead projectors "off," the Visual Response System classroom is basically the same as a regular classroom for the purposes of this study.

### Development of Study

The first task in the development of the study was to set the occasion for possible student-student interaction to occur. To accomplish this, a unit on "Categories" was developed by the project staff.

An initial list of possible categories (e.g., things that are commonly green, types of fish, etc.) was compiled and subjected to a one-minute timed writing trial during which three project staff members wrote as many words as possible that fit the particular category. Results of these trials were matched against a pre-specified criteria. Criteria for useful categories were no fewer than 10 total different words (words not shared by two or more staff members) and no more than 25 different words. Those categories which met criteria were then included in the study (see Table 18).

In order to measure the extent of student-student interaction in the Visual Response System as compared to a "non-Visual Response System" or regular classroom setting (i.e., student overhead projectors "off"), the categories were randomly assigned to "on" or "off" days. To determine student-student interaction across writing trials, as well as within trials, it was decided that three 3-minute writing trials would be conducted per day. The same category was used for all three writing trials on a specific day. Finally students were randomly assigned seats on a daily basis to allow each student an equal amount of "visual access" to each of the other student's work during the course of the study.

### Procedure

An orientation session was conducted to introduce students to both the Visual Response System and the unit on categories. Following the orientation, the study began with an "on" day. The general procedure was

Table 18. Categories Used in Student-Student Interaction Study

| Session No. | Category | Student Overhead Projectors "On" or "Off" |
|---|---|---|
| 1. | names of cartoon characters | on |
| 2. | types of birds | off |
| 3. | words that mean "good" | on |
| 4. | names of famous sports figures | off |
| 5. | names of hand tools | on |
| 6. | types of fish | off |
| 7. | types of bugs & insects | on |
| 8. | camping gear items | off |
| 9. | objects that are commonly hard | on |
| 10. | types of desserts | off |
| 11. | types of stores | on |
| 12. | names of engine parts | off |
| 13. | departments in stores | on |
| 14. | items that are cold | off |
| 15. | paper products | on |
| 16. | means of communication | off |
| 17. | names of comic strips | on |
| 18. | words that mean bad | off |
| 19. | items to eat that are sour | on |
| 20. | objects that are commonly green | off |

basically the same for both "on" and "off" days. First, students were informed as to whether their overhead projectors would be "on" or "off," then they were presented with the category for the day. The definition of the day's category, including two examples, were presented to the students via the teachers overhead projector.

Following the introduction of the day's category, a timer was set for three minutes and students wrote as many sentences as possible containing words from the day's category. No more than two category words could be used per sentence. This procedure was used for all three daily writing trials.

A reinforcement contingency was used throughout the study for all words written by students that met the definition of the daily category. Students were awarded points in the following manner: one point for writing a teacher given category word; three points for writing a new category word the first time; one point for writing a new category word the second time but in a different writing trial; and one point for decoding the clue word. Points were exchangeable for lottery tickets (10 points = 1 ticket) and a lottery was held each Friday. The two winners could select from a reward menu that included, soda pop, cigarettes, and rock posters.

Between writing trials I and II, and II-III, a clue word was given. The clue word was a word that fit the category but was presented in scrambled form, or with letters missing. Clue words could be used by students in future writing trials. For a more complete description of teaching procedures, see Appendix IX.

Materials

The following teacher and student materials were used during the study.

Random seating chart transparency. A seating chart transparency was displayed for the students as they entered the Visual Response System each day. Students were assigned their seats each day according to a random schedule.

Teacher transparencies. Each day a teacher transparency was displayed that included the following: (1) the category title; (2) two sample category words, alone and in context; and (3) two clue words from the daily category (see Appendix IX). Information on the teacher transparencies was presented using the technique of progressive disclosure.

Student response materials. Student response materials for "on" days were acetate sheets containing 10 lines. On "off" days, students wrote on paper which contained 10 lines.

Daily recording sheets. A daily recording sheet (see Appendix IX) was used by the teacher to keep track of all words used by each student.

The daily recording sheet assisted the teacher in rewarding points and provided the Visual Response System staff with the daily data used to determine the amount of student-student interaction that took place each session.

## Evaluation Procedures

Following each session in the Visual Response System, words from the Daily Recording Sheet were compiled on a summary recording sheet (see Appendix IX). Six dependent variables were calculated and graphed. A multielement design (Ulman, Sulzer-Azaroff, 1975) was employed to determine differences between "on" and "off" sessions (i.e., Visual Response System and non-Visual Response System conditions) across six dependent variables.

The six dependent variables are defined below.

Total number of words per session. A word was defined as any word written by a student that had not been used previously by himself or any other student. The number of words were recorded by trial and totaled at the end of each session.

Student-student interaction index. The student-student interaction index was defined as the average number of students who used each word. The index for each session was calculated by totaling the number of students who used each word and dividing by the total number of words.

Number of shared words. A shared word was defined as a word written by two or more students within or across trials in each session. The number of shared words were compiled by counting the number of students who used each word.

Percentage of total words shared. The percentage of total words shared by 2 or more students was calculated using the formula:

$$\frac{\text{number of shared words used by X students}}{\text{total number of words per session}}$$

Student-student interaction within trials. Student-student interaction was defined as the use of a word by more than one student. Student-student interaction within trials was calculated by dividing the actual number of interactions of a particular trial with the total possible interactions within the same trial.

Student-student interaction across trials. Student-student interaction across trials was calculated by dividing the total number of interactions in a particular trial with another trial (i.e., trial two with trial one) by the total number of possible interactions remaining from the previous trial(s).

Results

Experimental data were collected on the six dependent variables described above. Measures of central tendency were compiled using the median to give a more accurate measure due to a few exaggerated scores on each dependent variable.

Total number of words per session. The total number of words per session (see Fig. 20) was also graphed per trial within each session (see Fig. 21). The total number of words produced on an "on" day ranged from 40-119 with a median score of 72.5 words. The total number of words produced on an "off" day ranged from 38-161 with a median score of 95.5 words. Trial 1 new words on an "on" day ranged from 8-46 with a median score of 33 words, while words on an "off" day ranged from 18-52 with a median score of 37. Trial 2 words on an "on" day ranged from 13-27 with a median score of 20. Trial 2 words on an "off" day ranged from 11-55 with a median score of 30. Trial 3 words on an "on" day ranged from 10-46 with a median score of 16.5 while new words on an "off" day ranged from 7-44 with a median score of 28 words.

Student-student interaction index. The student-student interaction index or the average number of students who used each word, (see Fig. 22) on "on" days ranged from 1.9-3.8 with a median score of 2.9. Student index on "off" days ranged from 1.2-2.5 with a median score of 1.45 words.

Number of shared words. The number of shared words (see Fig. 23) were recorded as the number of words shared by two or more students, three or more students . . . to seven or more students.

1. Two or more students--The number of words shared by two or more students during "on" days ranged from 28-59 with a median score of 47 common words. The number of words shared by two or more students during "off" days ranged from 12-43 with a median score 25 shared words.

2. Three or more students--The number of words shared by three or more students on "on" days ranged from 23-43 shared words with a median score of 33.5. The number of shared words on "off" days ranged from 5-26 with a median score of 9.5 shared words.

3. Four or more students--The number of words shared by four or more students on "on" days ranged from 14-33 with a median score of 26.5. The number of words shared by four or more students on "off" days ranged from 1-13 with a median score of 6.

4. Five or more students--The number of words shared by five or more students on "on" days ranged from 2-27 with a median score of 16.5 words. The number of words shared by five or more students on "off" days ranged from 0-8 with a median score of 2.5 words.

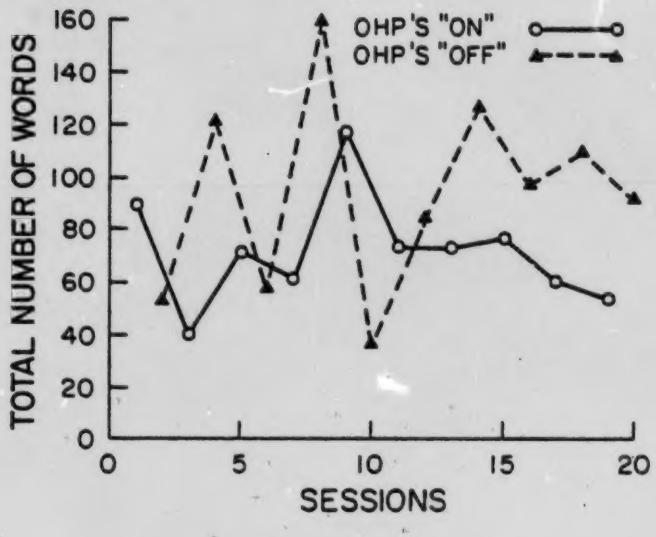


Fig. 20 - Total number of words per session

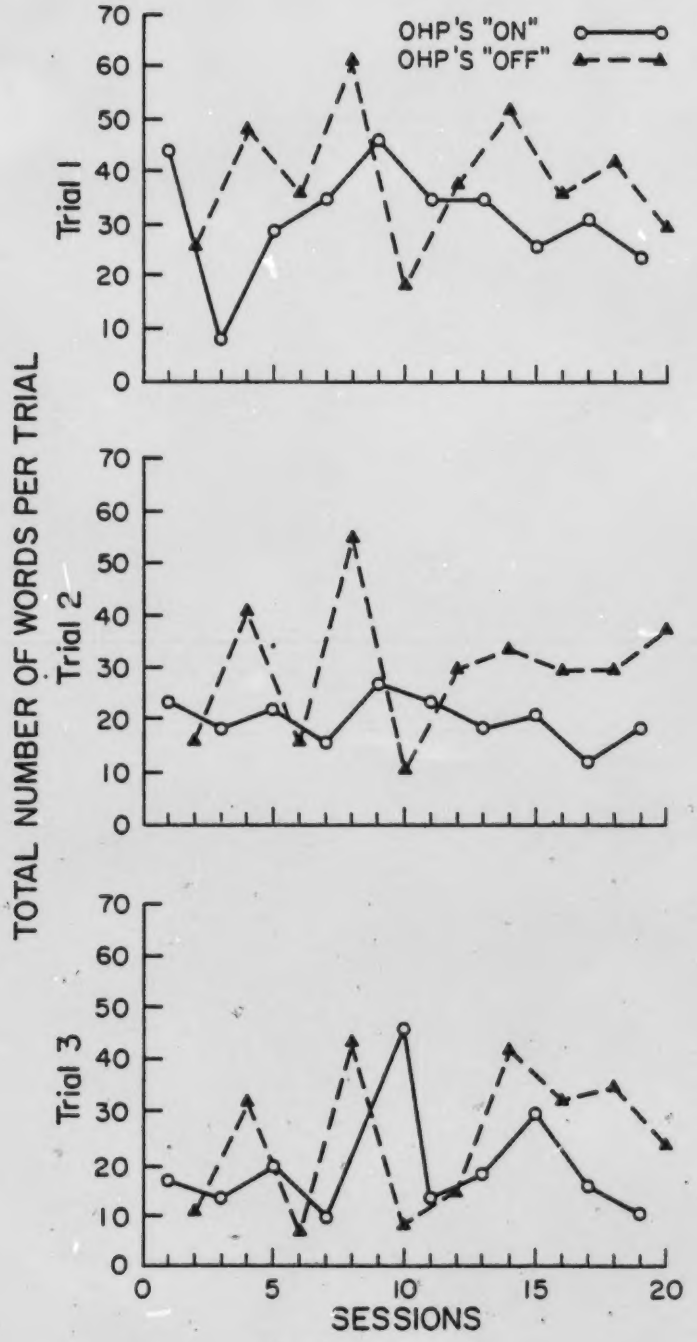


Fig. 21 - Total number of words per trial for each session

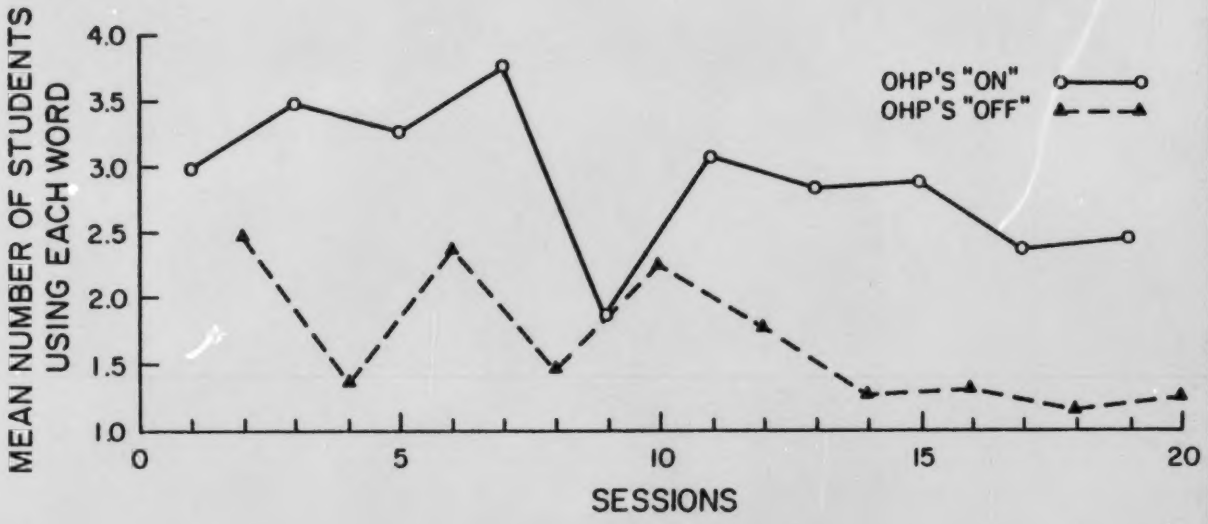


Fig. 22 - The average number of students who used each word

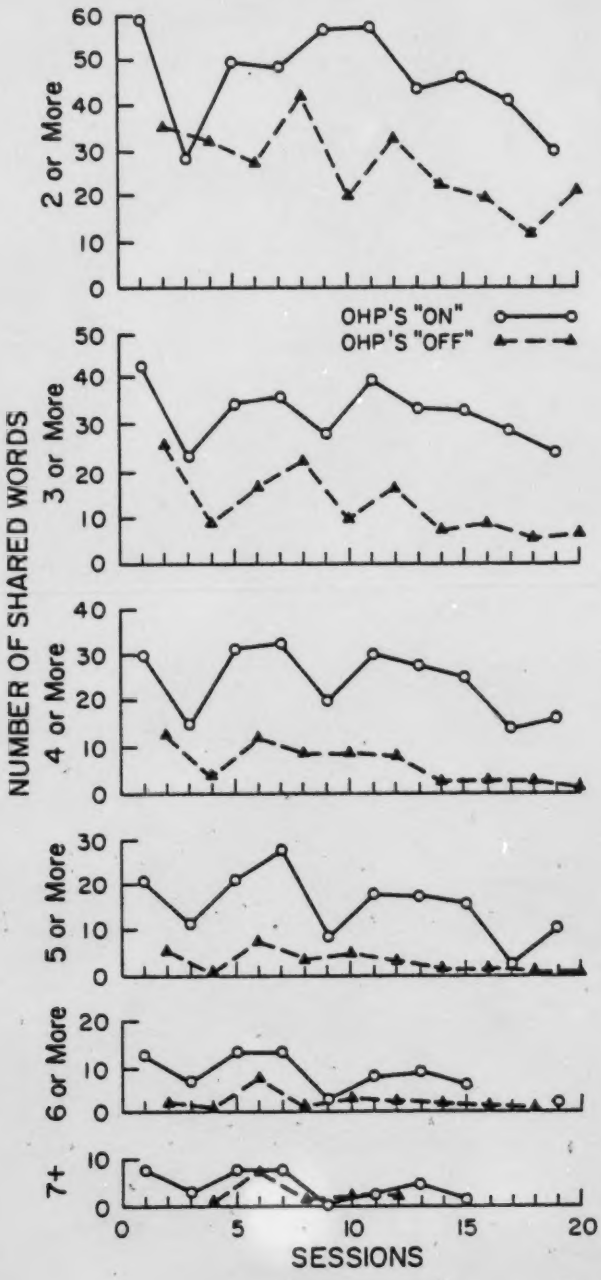


Fig. 23 - Number of shared words

5. Six or more students--The number of words shared by six or more students on "on" days ranged from 2-14 words with a median score of 7 words. The number of words shared by six or more students on "off" days ranged from 0-8 words with a median score of 2 words.

6. Seven or more students--The number of words shared by seven or more students on "on" days ranged from 0-8 with a median score of 4 words. The number of words shared by seven or more students on "off" days ranged from 0-2 with a median score of 1.5 words.

Percentage of total words shared. The percentage of total words shared (see Fig. 24) was recorded using the same format as used for number of shared words. Median scores for all 10 sessions in each condition were also graphed (see Fig. 25).

1. Two or more students--Percentage of total words shared by two or more students on "on" days ranged from 47-78.7% with a median score of 68.9%. Percentage of total words shared by two or more students on "off" days ranged from 10.9-64.8% with a median score of 27.3%.

2. Three or more students--Percentage of total words shared by three or more students on "on" days ranged from 24.3-59% with a median score of 48.5%. Percentage of total words shared by three or more students on "off" days ranged from 4.5-50% with a median score of 11.4%.

3. Four or more students--Percentage of total words shared by four or more students on "on" days ranged from 16.3-54.1% with a median score of 36.4%. Percentage of total words shared by four or more students on "off" days ranged from 1.1-24.1% with a median score of 3.1% shared words.

4. Five or more students--Percentage of total words shared by five or more students on "on" days ranged from 3.3-44.3% with a median score of 24%. Percentage of total words shared by five or more students on "off" days ranged from 0-13.5% with a median score of 2.3%.

5. Six or more students--Percentage of total words shared by six or more students on "on" days ranged from 1.7-21.3% with a median score of 12.3%. Percentage of total words shared by six or more students on "off" days ranged from 0-13.5% with a median score of 1.8%.

6. Seven or more students--Percentage of total words shared by seven or more students on "on" days ranged from 0-13.1% with a median score of 7.1%. Percentage of total words shared by seven or more students on "off" days ranged from 0-11.9% with a median score of 1.5%.

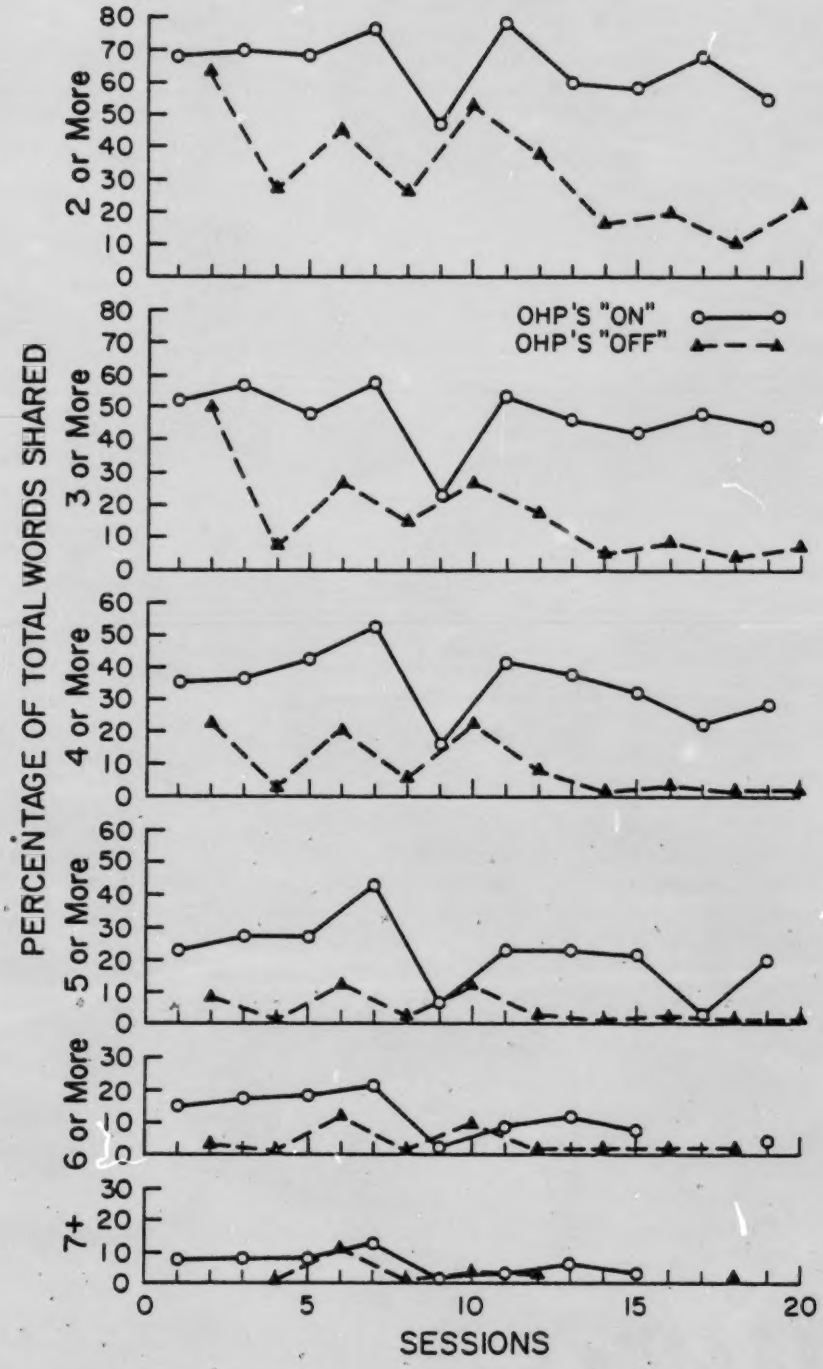


Fig. 24 - Percentage of total words shared

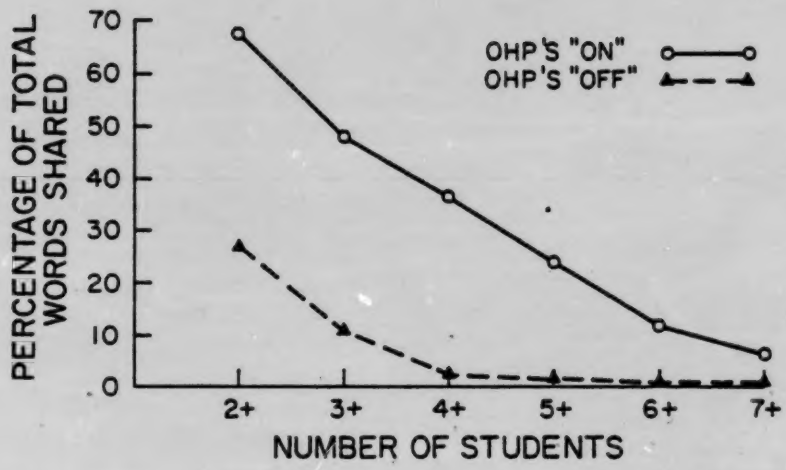


Fig. 25 - Median scores of the percentage of total words shared for all 10 "on" and "off" days

Student-student interaction within trials. Percentage of student-student interaction within each trial was recorded for all three trials per session (see Fig. 26).

1. Trial 1--Percentage of student-student interaction within Trial 1 on "on" days ranged from 9.7-43.8% with a median score of 15%. The percentage of student-student interaction within Trial 1 on "off" days ranged from 2.5-26.1% with a median score of 5.6%.

2. Trial 2--The percentage of student-student interaction within Trial 2 on "on" days ranged from 8.3-26.7% with a median score of 16.2%. The percentage of student-student interaction within Trial 2 on "off" days percentages ranged from 0.5-12.8 with a median score of 3.2%.

3. Trial 3--The percentage of student-student interaction within Trial 3 on "on" days ranged from 5.9-21.2% with a median score of 15.1%. The percentage of student-student interaction within Trial 3 on "off" days ranged from 0-6.0% with a median score of 2.7%.

Student-student interaction across trials. Two measures of student-student interaction across trials were taken: (1) Trial 2 with Trial 1; and (2) Trial 3 with Trials 1 and 2 (see Fig. 27).

1. Trial 2 with Trial 1--Percentage of student-student interaction across Trials 1 and 2 on "on" days ranged from 11.9-44.4% with a median score of 26.7%. Percentage of student-student interaction across Trials 1 and 2 on "off" days ranged from 0.8-26.0% with a median score of 6.9%.

2. Trial 3 with Trial 1 and 2--Percentage of student-student interaction across Trials 1, 2, and 3 on "on" days ranged from 5.9 to 24.7% with a median score of 19.1%. Percentage of student-student interaction across Trials 1, 2, and 3 on "off" days ranged from 1.2-8.3 with a median score of 3.5%.

## Discussion

Results of this study clearly indicate that significantly more student-student interaction takes place in the Visual Response System (projectors "on") as compared to a regular classroom situation (projectors "off") in terms of sharing written responses in a language arts activity.

The number of words shared by students was greater on "on" days across all combinations. The percentage of words shared by students was also substantially greater on "on" days across all combinations of students. Student-student interaction within trials was greater on "on" days than "off" days across all three trials. Student-student interaction within trials remained fairly constant in all three trials on "on" days, while

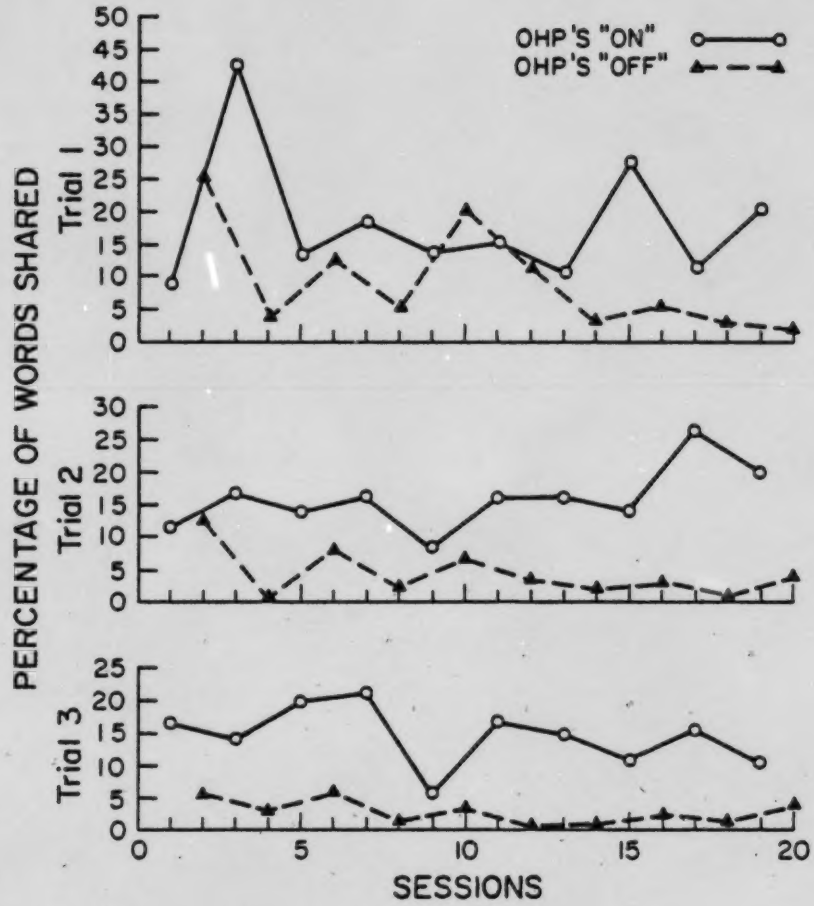


Fig. 26 - Percentage of student-student interaction within each trial

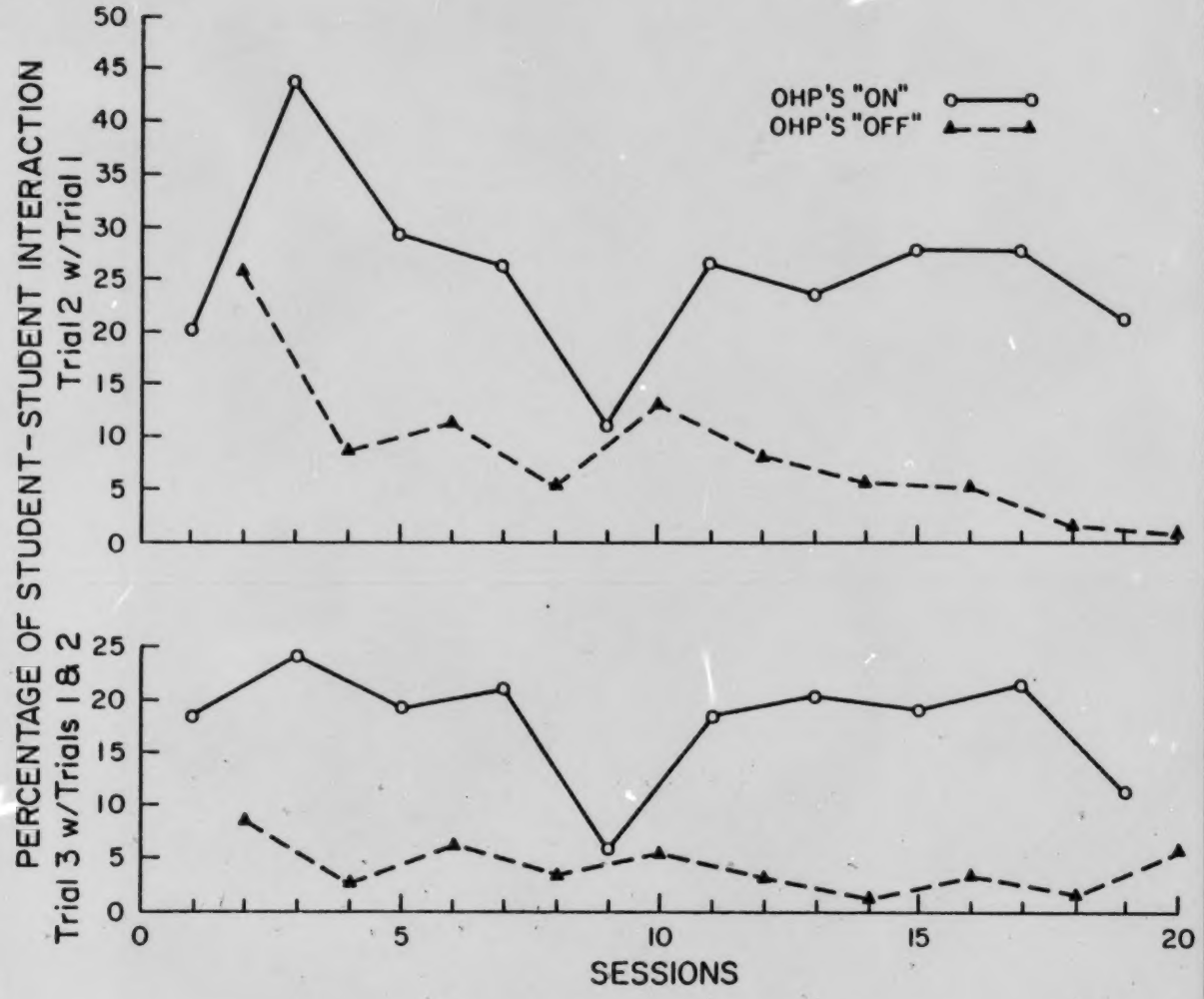




Fig. 27 - Percentage of student-student interaction across trials

student-student interaction within trials decreased from Trial 1 to Trial 3 on "off" days. Apparently the same amount of student-student interaction occurs throughout trials with overhead projector "on," while interaction decreases with the overhead projector "off."

Student-student interaction across trials was greater on "on" days then on "off" days. On "on" days, approximately 25% of all possible remaining interactions from Trial 1 are used in Trial 2. On "off" days, only 7% of the possible remaining interactions are used. On "on" days, approximately 20% of possible interactions remaining from both Trial 1 and 2 are used in Trial 3. On "off" days, only 3.5% of the remaining possible interactions are used.

Teaching implications. The results of this study hold important implications not only for teaching in the Visual Response System but in the regular classroom as well. While observational learning (modeling and imitation) has been demonstrated as a powerful learning phenomenom for a wide variety of social behaviors (e.g., Bandura, 1971), little research has been conducted on the effects of observational learning on the acquisition of academic behaviors. Even though most students are educated in groups, seldom do students have direct, continuous access to the responses of peers. The teacher is usually the only source of information for the individual learner. This study demonstrates convincingly that students will imitate appropriate academic responses of peers if given the opportunity. Teachers in regular classrooms should investigate the effects of systematically having students respond in "public" e.g., writing on the blackboard, posting children's work, and having students exchange and examine each other's work in small groups.

In terms of teaching in the Visual Response System, this study shows that student-student interaction does indeed occur at a much higher rate than in a regular classroom setting. Subsequent research is needed to determine how to manipulate the variables influencing that interaction and to use it in a meaningful way to help students learn.

Future research. This study raises more questions than it does answers. It serves only as an initial descriptive study measuring the extent of student-student interaction in one type of learning activity. Other experiments must be conducted to measure the amount and type of student-student interaction in other subject areas and activities. Not only would additional investigations of this phenomenom be useful to further development of teaching strategies for the Visual Response System in particular, but data generated by such studies could be used to help understand the basic principles underlying observational learning in general. For example, while many studies have been conducted on modeling of social behavior little has been done with academic responses. The Visual Response System is an excellent environment for systematically studying the effects of many variables believed to effect observational learning--peer status, visibility of responses, and the effects of reinforcement (both type and schedule) to name just a few.

## Student Reactions to the Visual Response System

In addition to instructional evaluations, data were collected to determine student reactions to the Visual Response System. Students who participated in the various Visual Response System instructional units were interviewed. A sample of the Visual Response System Student Evaluation Interview form is in Appendix X. Student interviews were conducted orally due to the low reading level of some students.

Fifty-two students were interviewed by members of the project staff. No student was interviewed by the same person who served as their teacher in the Visual Response System. Twenty-six student interviews were recorded on tape and reviewed by an independent observer to obtain reliability. Reliability was 100% for all interviews taped. Students were asked to respond to nine different questions. Following are the results of the student interviews and a brief discussion of each question.

### Compare the Visual Response System with Other Classes

Forty-four students said the Visual Response System was better, three said it was worse, and five were neutral. A large majority of students stated the Visual Response System compared favorably with the regular classroom. Following are some representative comments:

1. "rather go to VRS than go to school,"
2. "fun, learned more,"
3. "individual attention,"
4. "good in the beginning but boring in the end."

### What Did You Like About the Visual Response System?

Student reaction to this question ranged from music (17 students), to equipment (9 students), to the lottery (3 students) held by various teachers with points earned in the Visual Response System. Other comments were:

1. "saw things better,"
2. "see mistakes and can correct immediately,"
3. "see daily improvement."

### What Did You Dislike?

The most common student response to this question was "nothing"--38 students. A sample of student comments follow:

1. "doing it everyday,"

2. "overhead projector's hard to write on,"

3. "lottery only once a week,"

4. "when tape broke."

How Did You Feel About Having Other Students See Your Work?

Results show 21 students stated having other students see their work as positive, 1 student saw it as negative, and 30 students were indifferent. A concern of project staff was that student behavior might be suppressed when overhead projectors were "on." Results indicate students either don't care or feel its a positive feature. A sample of student comments follow:

1. "none of their business"

2. "learn from others"

3. "helped me catch on better"

4. "good way to learn"

Compare the Difficulty of the Work in the Visual Response System to That of Your Other Classes

Four Students said the Visual Response System was harder, 41 said easier, and 6 said the regular classroom and the Visual Response System are the same. Students stated that the Visual Response System was hard in the beginning but easy after they understood what they were to do. Some representative comments follow:

1. "don't read from a book,"

2. "answer right away,"

3. "correct mistakes immediately,"

4. "new stuff made it hard."

How Did You Feel About Working for Points?

Thirty-nine students stated working for points was a positive aspect of the Visual Response System, 2 students felt it was negative, and 9 were indifferent. Results show that students appear to enjoy working for points. A sample of student comment follows:

1. "made me try harder,"

2. "builds confidence,"

3. "work for something,"

4. "keep track of correct answers."

Did You Feel That You Were Competing with Others in Your Class?

Thirty students said yes, 18 said no, and 4 said sometimes. Whether students felt they were competing or not, 37 students felt comfortable with earning points. Representative student comments follow:

1. "try to do my best,"

2. "motivation,"

3. "something to look forward to,"

4. "not to learn but to earn points."

Did the Visual Response System Keep You Interested in Your Work Better Than Other Classes?

Forty-one students answered yes, 9 answered no, and 2 answered sometimes. Some student comments follow:

1. "I think about it in English,"

2. "didn't get bored,"

3. "time went faster,"

4. "fast way to learn."

Did You Enjoy Having Music to Listen to While You Worked?

Forty-nine students responded "yes," two students responded "no," and one was indifferent. Students enjoy having music to listen to while working, and, while two students said they did not like the music, the problem is easily remedied by simply turning off the music to those particular students by placing the intercom switch in the "off" position. Only one student commented further, "it made my body relax."

Summary

Results of the Visual Response System student interviews indicate students do like the Visual Response System. They like the individual attention, music, the chance to work for points and working with the equipment. Students are not concerned with other students being able to see their work. The major complaint was the Visual Response System began to get boring after awhile.

A possible explanation for those few students who felt the Visual Response System became boring is that they participated in programs evaluating instructional techniques and materials, particularly the program on completing employment applications. This program had to run longer than it normally would to allow for repeated measures of the students' performance. Nevertheless, experience from this project suggests that specific Visual Response System lessons should not last beyond two to three weeks.

## Summary

This section presented a description of studies conducted by Visual Response System Demonstration Project staff members to evaluate the Visual Response System as an instructional environment for mildly handicapped students. Following are very brief summaries of each study.

### Employment Applications

Students were taught to complete employment applications in the Visual Response System. Results showed all students ability to complete employment applications improved and maintained in a two-week follow-up. Results indicated some generalization of learned behaviors, but more research is needed to improve generalization. Completion of employment applications is an important skill for both the juvenile delinquent and mildly handicapped populations. A major employment skills unit is presently under preparation.

### Mathematics--Fractions

A study was conducted to teach addition, subtraction, multiplication, and division of fractions. A unique aspect of this study was the use of fraction blocks. Fraction blocks enabled students to deal with an abstract idea in a concrete manner. Results indicate student performance increased and maintained in all four skills. The Visual Response System appears to be an effective environment to teach mathematics. More research in this area needs to be conducted.

Composition

A study was conducted to improve compositional writing of mildly handicapped youths. Results of the study indicate that direct reinforcement of correct usage of syntax leads to an increase in the behavior. An interesting aspect of this study was the emphasis on positive aspects, to increase usage by reinforcing the occurance, no "teaching" in the traditional sense was done. This is in opposition to the typical writing class where mistakes are emphasized.

Punctuation

A study was conducted to teach proper usage of punctuation. Results indicate students correct use of punctuation increased with training. Further research needs to be conducted to determine the ability of the Visual Response System to deal with individual problems in a small group. Initial results from the present study indicate individualization is possible. More systematic techniques need to be developed and researched.

Spelling

A unit was developed to teach spelling in the Visual Response System. Initial results are mixed. All students appeared to learn the words, but few students were able to maintain the words. Research needs to be conducted on maintenance techniques. In addition, the efficiency of using the Visual Response System for spelling needs to be investigated.

Science--Photosynthesis

A study was conducted to teach the concept of photosynthesis. Results of this study show students learned and maintained information at a high level. The Visual Response System appears to be an effective environment for teaching science concepts. More science units should be developed and field tested.

Self-Management

A study was conducted to teach self-management skills to juvenile delinquent youths. Results indicate all students changed their targetted behaviors in the appropriate direction. The Visual Response System could be used to teach self-management skills to other populations, i.e., teachers, social workers, and group leaders.

Student-Student Interaction

A study was conducted to determine the amount of student-student interaction that occurs in the Visual Response System with the overhead

projectors "on" and "off." Results indicate that student-student interaction is significantly greater with the overhead projectors in the "on" position than in the "off" position. Research needs to be conducted to determine methods of incorporating student-student interaction into Visual Response System lessons.

## Student Reactions

Fifty-two students were interviewed to determine their reactions to the Visual Response System. Student reactions were positive. Students do enjoy working with the equipment, earning points, and receiving individual attention in the Visual Response System. Students stated they were comfortable with having their work projected in front of their peers.

## Conclusion

Results from this project demonstrate the Visual Response System to be an effective learning environment for small groups of mildly handicapped students. Additionally, students enjoy the Visual Response System.

## IV. INSERVICE TRAINING

The second major goal of the Visual Response System Demonstration Project was to train inservice personnel in the effective use of the VRS as an instructional environment for mildly handicapped students. To accomplish this goal, the Visual Response Inservice Teacher Training Program was developed and evaluated with three groups of teachers at The Buckeye Youth Center.

### Development of Content/Skills to be Taught in the Inservice Program

In 1974, the Teacher's Handbook for Use with the Visual Response System was published by the Northeast Regional Media Center for the Deaf (Heward, 1974a). This handbook provided teachers with an introduction to the Visual Response System and suggested a variety of instructional strategies and procedures. The Handbook also provided a starting point for the project's inservice program, and, in revised form, served as the core of the inservice program.

Additional input to content of the inservice program was supplied through meetings with Dr. Raymond Wyman, the originator of the VRS (Wyman, 1968). Dr. Wyman was helpful in providing ideas for teaching the use of the Visual Response System hardware as he is one of the world's foremost authorities on the overhead projector.

Also, input on content areas was gathered from teachers at The Model Secondary School for the Deaf in Washington, D. C., and The Tennessee School for the Deaf in Knoxville, Tennessee. It was through this input that teaching the systematic use of behavior modification principles as related to the VRS was added to the inservice program.

From these various sources a Visual Response System Inservice Teacher Training Program was developed which consisted of four major areas: (1) operation of the Visual Response System hardware; (2) local production of software; (3) instructional techniques; and (4) Visual Response System lesson plan production. A complete list of the objectives for these areas follows.

### Instructional Objectives

1. Presented with the Visual Response System, the trainee will operate the following components correctly 100 percent of the time.

A. Teacher Console

1. master OHP switch
2. student OHP switches
3. feedback system

    a. counters
    b. lights

B. Sound System

1. tape recorder
2. intercom

C. Projectors

1. overhead projectors
2. filmstrip projector
3. slide projector

2. Given the Visual Response System Instructional Checklist (see Appendix XI), the trainee will perform the stated operations with 100 percent accuracy.

3. Given the Visual Response System Trouble-Shooting List (see Appendix XI), the trainee will perform the stated operations with 100 percent accuracy.

4. The trainee will know how to use and combine various modes for presenting instructional materials in the Visual Response System.

5. The trainee will know how to present materials on the overhead projector for maximum effectiveness.

6. The trainee will specify two criteria for selecting student response materials.

7. The trainee will state the following instructional strategies and their application to the Visual Response System:

A. principles of reinforcement

B. schedules of reinforcement

C. types of reinforcers

D. how to determine reinforcers

8. The trainee will state the following principles of token economy systems:

A. what is a token system

B. guidelines for token presentation

C. when and how to exchange tokens

D. economic principles of a token system

E. how to set up and conduct a token system in the Visual Response System

9. The trainee will demonstrate three procedures for remediating student errors in the Visual Response System.

10. The trainee will describe six techniques to promote the generalization of skills learned in the Visual Response System to the regular classroom.

11. The trainee will describe four techniques for preventing and dealing with disruptive behavior in the Visual Response System.

12. The trainee will state two criteria for selecting commercial materials for use in the Visual Response System.

13. The trainee will demonstrate competency in the local production of software for the Visual Response System.

14. The trainee will prepare a complete Visual Response System Lesson Plan meeting all specified criteria.

Materials

Following is a list of materials, with a brief description, used in the Visual Response System Inservice Teacher Training Program.

Teaching in the Visual Response System (Heward and Test, 1978). This is the revised teacher's handbook. It was not used with the first group of teachers trained by the project as it was not yet ready. However, the book was used with Groups II and III, where it was distributed in the first session of the inservice program along with the schedule of the topics for each session. This schedule contained a corresponding list of page numbers in the handbook to allow the trainees to read about each topic as it was covered in the inservice program.

Visual Response System Teacher Certificate. This certificate was awarded to all trainees who mastered each of the 14 instructional objectives. The certificate was required of all teachers before they were able to teach in the Visual Response System. A sample of the certificate can be found in Appendix XI.

Visual Response System slide-tape show. A 15 minute narrated slide-tape show of the history, instructional advantages, and some of the past and present research on the Visual Response System was developed. The slide-tape show was shown in the first session of all three inservice programs as a general introduction to the Visual Response System. The slide-tape show was also presented at several professional meetings and conferences (see p. 128).

Visual Response System demonstration lesson. The Visual Response System demonstration lesson was presented on the first or second session of each inservice program depending on the amount of time available. The Visual Response System demonstration lesson introduces the capabilities of the Visual Response System. The lesson contains a demonstration of the hardware as well as sample teaching activities which include homonynms, sentence writing, math, math bingo, and a two-digit-plus-two-digit math speed test.

Pre-Posttest. The pre-posttest was given at the beginning of the first session of all three inservice programs and again in the last session of the program. The pre-posttest consisted of 21 questions. Questions ranged from presentation techniques and instructional techniques to writing a Visual Response System lesson plan. The pre-posttest was developed to assess the trainee's verbal knowledge of the Visual Response System. A sample of the pre-posttest can be found in Appendix XI.

Transparencies. Transparencies were used to convey the major concepts presented during the inservice program. There were two types of transparencies, lecture and assessment. Lecture transparencies were used to present information to the trainees, while assessment transparencies were used in place of written quizzes. See Appendix XI for samples of each type of transparency.

Daily evaluations. Daily evaluations were given at the end of each objective to determine mastery on each objective. Evaluations were either demonstration (requiring trainee demonstration of the objective) or written (assessment transparencies). A list of all assessments can be found in Appendix XI.

Questionnaires. Two types of questionnaires were used in the Visual Response System Inservice Teacher Training Program: the Trainee Questionnaire, and the Visual Response System Inservice Questionnaire.

The Trainee Questionnaire was completed during the first session of each inservice program. The questionnaire was used to gather information on each trainee's educational background.

The Visual Response System Inservice Questionnaire was completed during the final inservice session and was used to gather the trainees' reactions to the inservice program and to determine if the trainees felt they knew the information presented in the Visual Response System Inservice Teacher Training Program. Examples of each questionnaire can be found in Appendix XI.

Software production materials. Various materials for producing transparencies were used during the inservice program. These included:

(1) write-on transparencies;

(2) heat-transfer transparencies;

(3) transparency frames; and

(4) permanent and non-permanent transparency markers.

## Procedure

In developing the Visual Response System Inservice Teacher Training Program, a list of objectives was written with a projected time span attached to each objective. This time span was the amount of time (both shortest and longest amounts) it was estimated it would take to complete each objective. By adding the estimated time each objective would take to complete, it was decided that the inservice program could be taught in approximately 11 hours. Because the Visual Response System Inservice Teacher Training Program was held during school hours where each period was 50 minutes in length, it was decided to conduct the inservice program in 12 sessions. In order to train the teachers in the fastest time possible without taking them out of the classroom everyday, it was decided to conduct the inservice program three times a week (Monday, Wednesday, and Friday) for four weeks.

Because the inservice program was conducted during school hours, accommodations had to be arranged to allow the trainees to participate in the program. To allow participation, the inservice sessions were held during the preparation periods for the majority of the teachers. Classes of those trainees who were not free during the period the inservice program was held were covered by substitute teachers supplied by project staff.

## Inservice Pilot Program

Before the inservice program was begun with the trainees, a pilot inservice program was conducted with the staff of the Visual Response System Demonstration Project. The pilot inservice program was conducted in one, six-hour session. It covered all of the areas of knowledge, but concentrated on the Visual Response System hardware, local production of software, and Visual Response System lesson plan preparation. These three areas were covered following the exact format of the lesson plans, from information presentation to evaluation, except that trainees finished the take-home assignments immediately. Visual Response System instructional techniques were skimmed to allow comments, but the project staff was already knowledgeable about this information.

This pilot-test served three purposes: (1) to instruct the Visual Response System staff in the use of the Visual Response System; (2) to allow the inservice instructor a chance to practice the inservice program; and (3) to identify any problems that needed to be corrected before the Visual Response System Inservice Teacher Training Program was to be used with the trainees.

The Visual Response System Inservice Teacher Training Program. By December 24, 1978 all teachers at the Buckeye Youth Center had received inservice training in the effective use of the VRS. Twenty-four teachers had been trained in four groups. The procedure used in each inservice program varied slightly from group to group, but the major content areas and objectives remained the same across all inservice programs. Due to the changes in procedure from group to group the procedure used by Group III will be presented, as it is the end result of modifications.

Trainees met three times a week (Monday, Wednesday, and Friday) for four weeks. Week 1 included a general introduction to the Visual Response System Inservice Teacher Training Program and the first two components (teacher's console and sound system). Objectives 2 and 3 were covered with each piece of hardware. Week 2 included section three of Objective 1 (projectors) as well as Objectives 4, 5, 6, 12, and 13. Week 3 included Objectives 14, 7, 8, and 9. Finally, Week 4 included Objectives 10, 11, and the final evaluation of Objective 14.

Area I (Visual Response System hardware), II (local production of software), and IV (lesson plans) were covered in the following manner. The instructor presented information to the trainees through the use of lecture transparencies and straight lectures. The instructor would then demonstrate the use of the information presented. Demonstrations included operation of the various components of the teacher's console, sound system and projectors, a demonstration of lesson plans, how to prepare a lesson plan, and the local production of software, from planning the master to making a transparency in the Thermofax copier. After the demonstration, trainees were then given time in class to practice the information, or were required to complete projects for the next class session. Trainees were given time to practice with each component of the Visual Response System hardware as well as time to practice with the Thermofax. In-class practice time for lesson plan production consisted of selecting and breaking down a target skill for a lesson plan. In both software production and Visual Response System lesson plan preparations, trainees were given an assignment to complete for the next session. Upon completion of each objective, the instructor evaluated the trainees on the information. Evaluation of the trainees' ability to operate the Visual Response System hardware was conducted during the same session the information was presented. Evaluation of the trainees' software productions and Visual Response System hardware was also given during the session the information was presented. Evaluations for the software productions and Visual Response System lesson plans were given in the session after the information was presented. In both cases, the final product of each assignment was evaluated against a list of criteria. For a session by session schedule of the lesson plans, see Appendix XI.

The presentation format for Area III (instructional techniques) was different than for the other three areas. First, trainees were given reading assignments on the material to be covered in the next session. This allowed the trainees to become familiar with the information and enabled the lecture to proceed at a fast pace. Second, the instructor presented a lesson which demonstrated the techniques through the use of lecture transparencies, and trainees were assessed on paper-pencil knowledge using the same technique for written assessments used in Procedure I. Finally, feedback was provided to each trainee using the same format as in Procedure I. This presentation format lasted no longer than 30 minutes and allowed the trainees time at the end of each session to practice and refine their individual lesson plans before the final evaluation.

Finally, prior to the beginning of the third inservice program an arrangement was made with The Ohio State University to award two quarter-hours of university credit through the Faculty for Exceptional Children (Ed. Excep. 693, Independent Study) to all trainees who successfully completed all aspects of the inservice program.

## Evaluation of the Inservice Program

The Visual Response System Inservice Teacher Training Program was evaluated by five methods: (1) pre-posttests; (2) evaluation of trainee produced lesson plans and their presentations; (3) daily written or performance evaluations of information presented in the session; (4) final trainee questionnaire; and (5) attendance records.

Pre-Posttests. The pre-posttest was given during the first and last sessions of each inservice program. Trainees were allotted 30 minutes to complete each test. The pretest was given immediately following, opening comments on competency-based inservice programs in the first session. The posttest was given during the last inservice session after the last trainee had completed his/her lesson plan presentation for final evaluation.

The pre-posttest was a written assessment of the principles covered during the Visual Response System Inservice Teacher Training Program. The pretest allowed the instructor to recognize any areas in which the trainees may have had previous knowledge. This enabled the instructor to concentrate more heavily on areas which the trainees had the least amount of knowledge.

The posttest allowed the instructor to check the verbal knowledge of each trainee as well as provide feedback on the effectiveness of the inservice. When problems arose on a particular question, this indicated a need for revision in the presentation of information or in the test question. The pretest was also useful to the trainees. It allowed the trainees to focus on what the instructor felt were the important points to be covered during the inservice program. A copy of the pre-posttest can be found in Appendix XI.

Interobserver reliability. Interobserver reliability checks were conducted by having two independent graders (one of whom was the inservice instructor) grade each test, marking all correct responses on a separate sheet of paper. Percentage of agreement between the two observers was determined by dividing the total number of agreements between both observers by the total number of agreements, plus the total number of disagreements.

Reliability checks were taken on two aspects of the pre-posttests: (1) the number of complete questions answered correctly, and (2) the percentage of total responses answered correctly (many questions required more than one response).

Trainee lesson plan presentation. Each trainee was required to produce and present a 10-minute lesson plan as a final evaluation (some examples of trainee-produced lesson plans can be found in Appendix XI).

Before a trainee was permitted to perform his or her lesson plan for the final evaluation, the lesson plan had to meet the specified criteria. A lesson plan was required to achieve 10 out of 11 or 11 out of 12 points (depending on their use of teaching materials, 3E), on the following elements.

1. Objective (1 pt.)

   A. Does it state what lesson will do?

2. Student Response (1 pt.)

   A. Does it state what type of student response(s) will be required?

3. Teaching Materials (4 or 5 pts.)

   A. Are all materials stated?

   B. Do all materials occasion active student response?

   C. Will materials occasion the student response stated in 2A?

   D. Are materials organized for ease of student understanding?

   E. If materials are locally produced, do they meet these criteria? (optional)

      1. uncluttered
      2. letter size
      3. one basic idea per transparency

4. Student Response Materials (2 pts.)

A. Are all materials stated?

B. Are response materials organized to allow teacher to find answers easily?

5. Feedback (2 pts.)

A. Is a reinforcement procedure stated?

B. Is the manner of remediation stated?

6. Evaluation (1 pt.)

A. How will the teacher record student responses?

Each trainee was required to go through two steps before presenting his/her lesson plan for the final evaluation. First, the trainee's lesson plan was required to meet the criteria stated above and second, the trainee was required to practice his/her lesson using the other trainees as students. These practice sessions were pre-arranged for sessions 8, 9, and 10. Only after completing these two steps were trainees allowed to present their lesson plan for final evaluation. A sample of the final lesson plan evaluation forms can be found in Appendix XI.

Trainees' lesson plans served both as a comprehensive evaluation of the trainee's ability and as an evaluation of the effectiveness of the Visual Response System Inservice Teacher Training Program.

The lesson plans allowed the instructor to evaluate the trainee over all four major areas of material presented in the inservice program. When presenting his/her lesson plan, each trainee was required to operate the Visual Response System hardware, use the different instructional strategies, plan a lesson and produce the necessary software. The lesson plan presentation also allowed the instructor to identify any common weaknesses among the trainees. A common weakness signaled an area of the inservice program that was in need of modification.

Daily evaluations of trainees. Daily evaluations of the trainees were conducted by both practical demonstration and written formats.

Practical evaluations consisted of trainees demonstrating specific skills, such as operation of the hardware, or by producing permanent products, such as transparencies and lesson plans. Practical evaluations were used for Objectives 1, 2, 3, 13, and 14. (Evaluation forms can be found in Appendix XI.)

Written evaluations covered information presented to the trainees. In the Visual Response System Inservice Teacher Training Program questions were presented using the teacher's overhead projector and trainees responded by writing their answers on blank transparencies with their overhead projectors "off." Trainees' answers were then evaluated with all

overhead projectors "on." Written evaluations were used for Objectives 4-12 and 14. (Written evaluations can be found in Appendix XI.) These daily trainee evaluations enabled the instructor to observe trainee learning, spot objectives that needed modification, and allow trainees knowledge of specific areas in which they needed remediation.

Trainee questionnaire. During the final session of the Visual Response System Inservice Teacher Training Program trainees were asked to fill out a questionnaire. This anonymous questionnaire allowed the trainees to comment on the strengths and weaknesses of the inservice program, to comment on whether they thought they would use the Visual Response System, and whether the trainees felt they had learned all the material that was presented to them during the program. The results of this questionnaire were used to modify the inservice program. (A copy of this questionnaire can be found in Appendix XI.)

Attendance records. Trainee attendance records were kept and all trainees were required to make up all information and evaluations missed as a result of absenteeism. Material was made up in two fashions: (1) if the material required a practical assessment the trainee was required to make up the material by attending a special individual session during their lunch break or preparation period; or (2) if the material missed covered instructional techniques, the trainee was required to read the corresponding information in Teaching in the Visual Response System and complete the written assessment by the next inservice session.

Trainee performance on each evaluation was compared to trainee attendance for the corresponding session(s). This comparison provided some information as to the effectiveness of Teaching in the Visual Response System, as make-up work was assigned in the handbook whenever possible. Thus, scores of those attending a particular inservice session could be compared with a trainee who was absent and was required to read the information before taking the evaluation.

## Results

Although four inservice groups were conducted, detailed performance data were only recorded for the first three groups. Data were recorded for the first three groups as part of a master's thesis conducted by the project research associate in charge of the inservice program (Test, 1978). Although detailed data were not kept for Group IV, participants were still required to master the same competencies as were participants in Groups I-III.

Figure 28 shows the average number of pre-posttest questions answered correctly by Group I, II, and III. All 19 trainees answered an average of 3.6 questions totally correct on the pretest and 13.2 questions totally correct on the posttest.

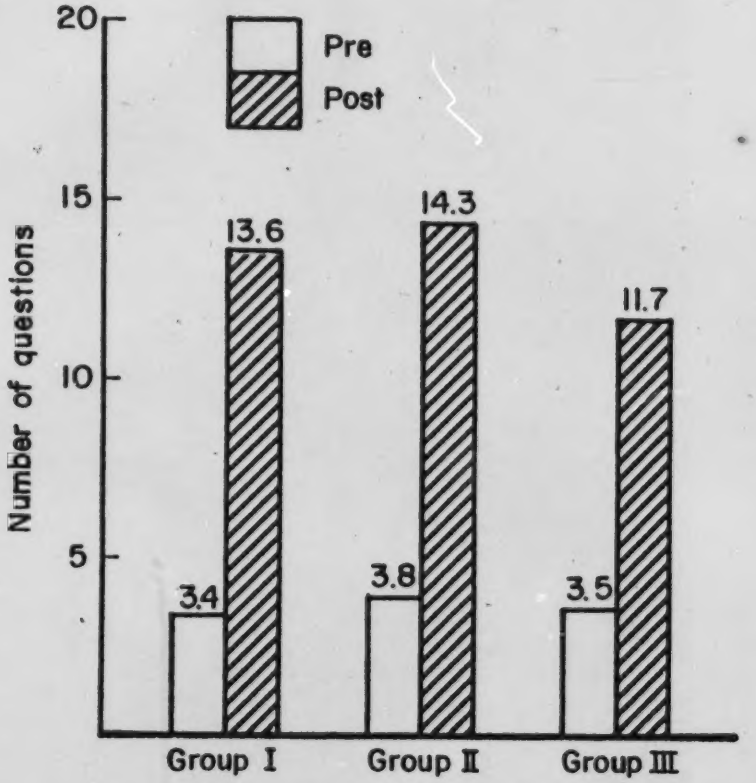


Fig. 28 - Average number of questions answered correctly on the pre-posttests by each group

Figure 29 shows the average percentage of total responses answered correctly by Groups I, II, and III. All 19 trainees averaged 15.2 percent correct on the pretest and 69.3 percent correct on the posttest.

Figures 30, 31, and 32 show the mean percent correct on each daily evaluation for Group I, II, and III, respectively. Group averages were 94.3, 93.7, and 96.6 percent correct on all daily evaluations for Groups I, II, and III respectively. All 19 trainees averaged 94.8 percent correct on all daily evaluations.

Group averages on the final lesson plan evaluation were 95.0, 96.5, and 97.4 percent correct for Groups I, II, and III, respectively. The 19 trainees scored an average of 96.3 percent of all possible points on the final lesson plan evaluations. The major problem encountered in the final lesson plan was failure of trainees to use verbal reinforcement.

Trainee Developed Lesson Plans

Brief descriptions of the lesson plans developed by trainees follow:

Group I, trainee 1--check writing lesson. Trainee 1 began the lesson by presenting a transparency of a blank check. She then modeled the correct procedure for filling out a check to the students. Students were then presented with instances for which they were to write checks. Students received one point for each blank on their check filled in correctly and contingent music for working.

Group I, trainee 2--weather lesson. Trainee 2 presented the symbols for cold and warm fronts. Students were then required to identify each symbol and draw it. The final phase included placing warm and cold fronts on a map of the United States. One point was given for each correct response.

Group I, trainee 3--sentence writing lesson. Students were presented a definition of a sentence, including the capitalization of the first word and ending with a period. Students were then required to write correct sentences describing a projected picture. Students received one point for each correct sentence and contingent music for working.

Group I, trainee 4--reading want ads. Students were presented with a transparency of common want ad abbreviations and their definitions to study for one minute. Students were then required to identify and match common abbreviations found in newspaper want ads. Students received one point for each correct response and contingent music for working.

Group I, trainee 5--checking account deposit slip lesson. Trainee 5 presented a blank deposit slip and a sample amount of money to be deposited. She then modeled the procedure for grouping money into currency, coins, and checks and how to enter the amounts on the deposit slip. Students

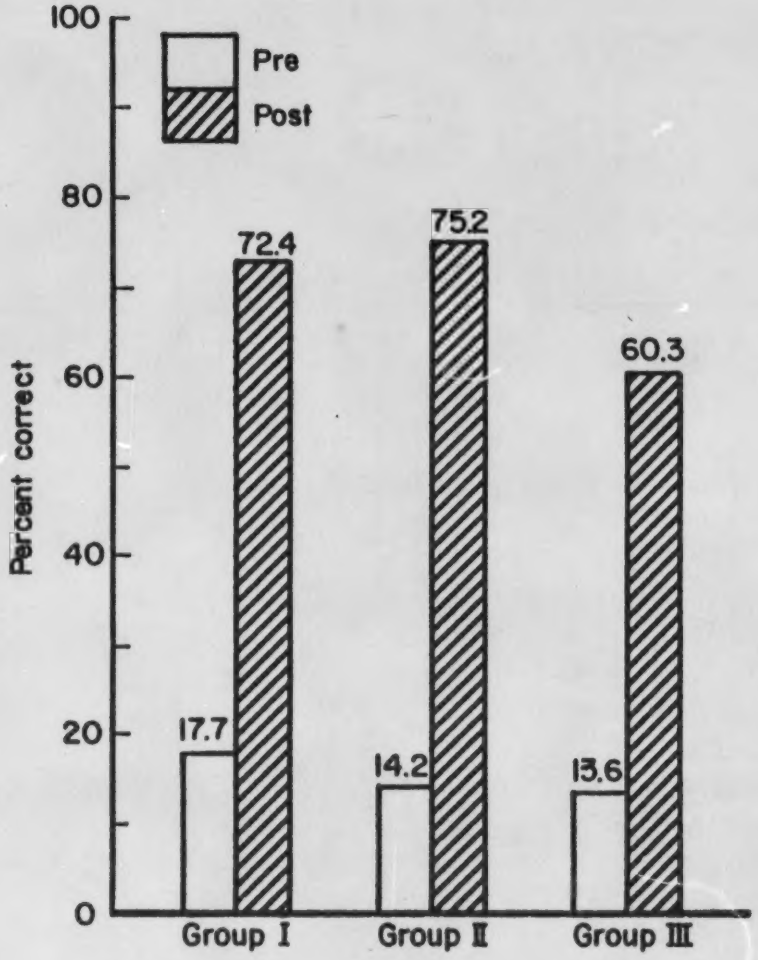


Fig. 29 - Mean percentage of total responses answered correctly by each group

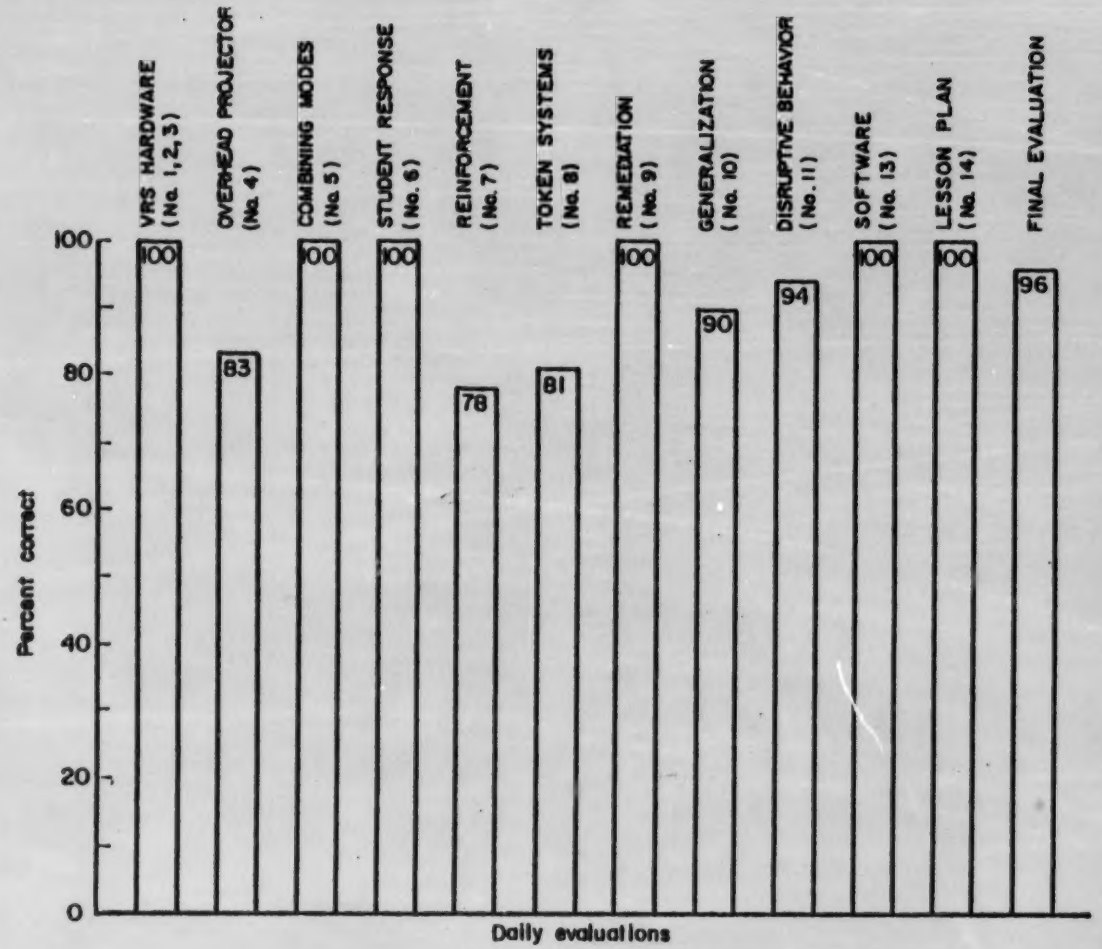




Fig. 30 - Class mean percent correct on each daily evaluation (Group I)

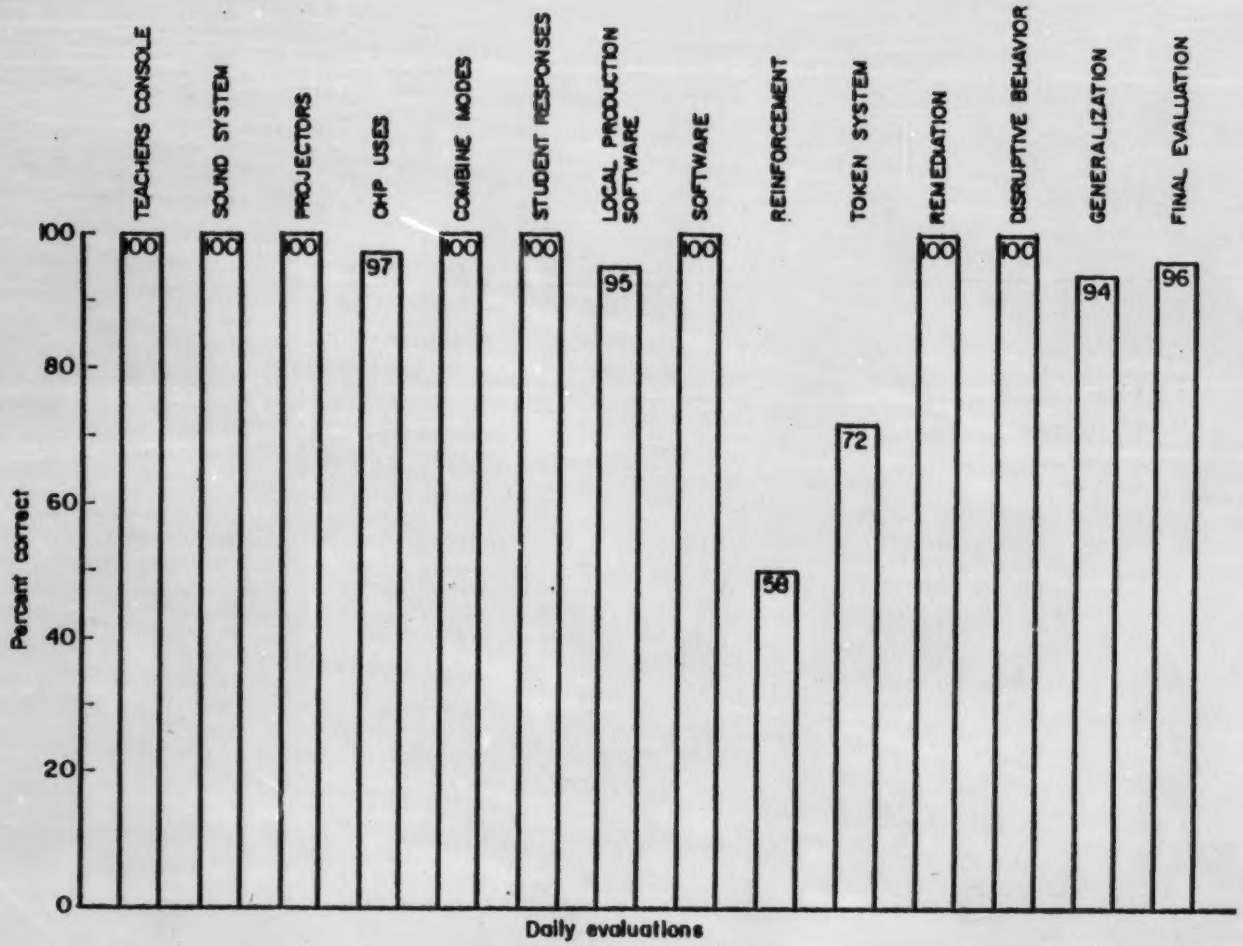


Fig. 31 - Class mean percent correct on each daily evaluation (Group II)

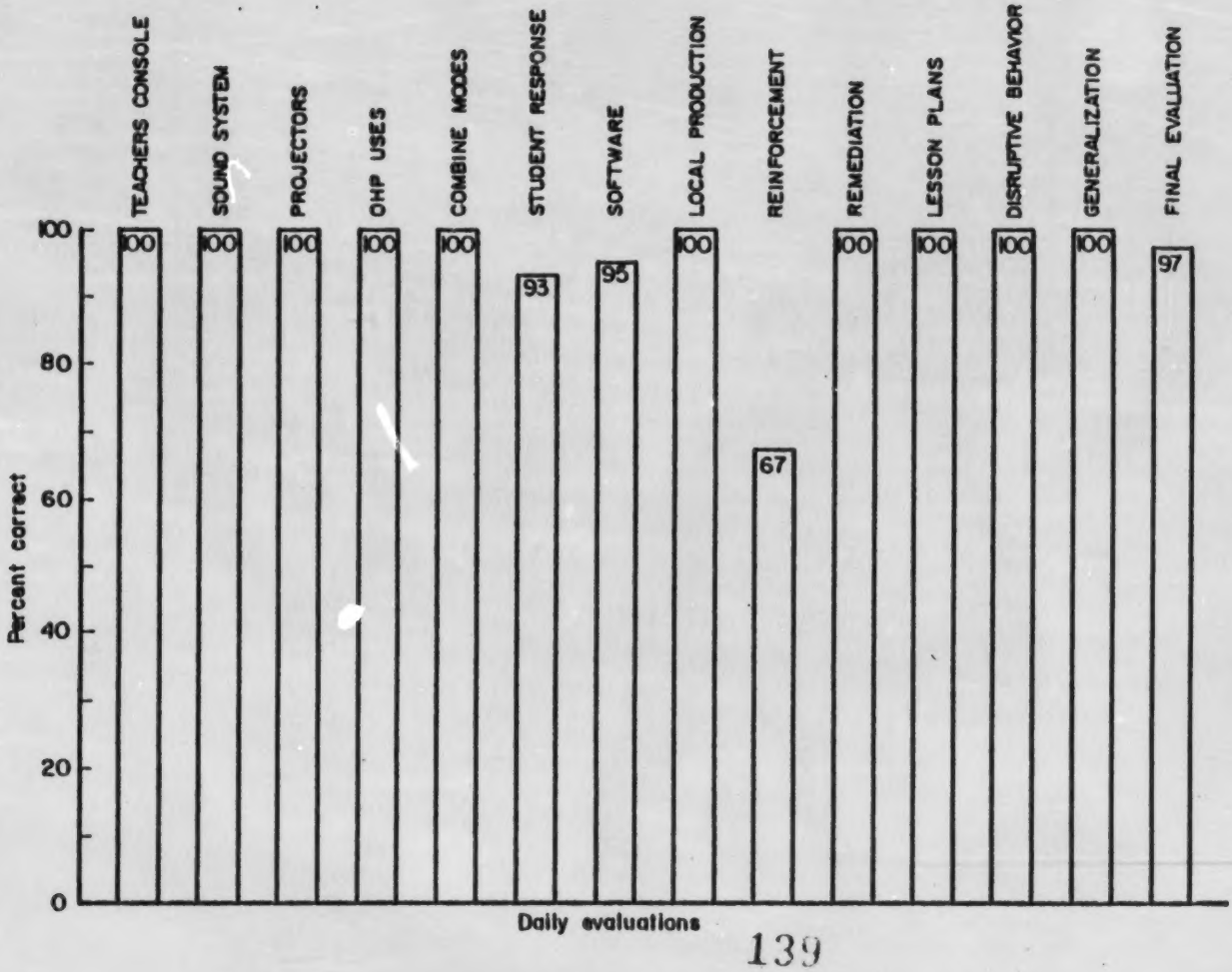




Fig. 32 - Class mean percent correct on each daily evaluation (Group III)

were then presented with various amounts of money and required to fill out the deposit slip accordingly. Points and music were given contingent upon performance.

Group I, trainee 6--suffix lesson. Students were first presented with a transparency containing various suffixes and their meanings. After studying this for one minute students were required to match suffixes to root words to form a specific definition. One point was given for each correct answer and contingent music for working.

Group I, trainee 7--math addition lesson. Students were presented with a transparency containing 25, 2 digit plus 2 digit addition problems. Students were required to copy each problem and solve the problem on their answer sheet. Points and music were given contingent upon working.

Group II, trainee 1--reconciling a checkbook. Trainee 1 presented a transparency of a reconciliation form and a sample problem to the students. She then modeled the correct procedure for reconciling a bank statement. Students were then given some sample figures and required to reconcile their statement. One point was given for each correct step and the students received contingent music for working.

Group II, trainee 2--initial consonant blends. Trainee 2 presented a transparency with various pictures of objects each having an initial consonant blend for each picture. Students were given points for correct answers and contingent music for working.

Group II, trainee 3--using the card catalogue. Students were taken through the various steps of how to use a card catalogue in a multimedia presentation that included the cassette tape deck, 35 mm slide projector, and the teacher overhead projector. The lesson covered selecting a topic, deciding on the first letter of the topic, locating the correct drawer and, finally, finding it among the cards. Students were required to identify in which drawer they would find each specific topic listed on the teacher's overhead transparency. Students received one point for each correct answer and contingent music for working.

Group II, trainee 4--prefixes. Trainee 4 presented the students with a transparency containing a list of prefixes and their definitions. Students were required to add prefixes to root words to form words with specific meanings. Students received one point for each correct answer.

Group II, trainee 5--straight line figures. Students were required to connect similar points on the X axis with those on the Y axis (i.e., 1 to 1, 2 to 2...). The figures, although formed with straight lines, appeared to be curved. Students received points for correctly drawn figures and music contingent upon working.

Group II, trainee 6--employment problems. Trainee 6 presented a list of reasons why most employees are fired, and gave examples of each. Students were then presented with situations and required to state which of the previously presented problem was occurring.

Group III, trainee 1--perspective. The objective of this lesson was to teach perspective to a vanishing point. The lesson was presented in steps with the trainee first presenting a step and the students then reproducing the step. This continued until all students had drawn three boxes in perspective to a vanishing point. Students received one point for each correctly performed step and contingent music for working.

Group III, trainee 2--branches of the United States Government. Students were shown a transparency containing the three branches of government and the functions of each branch. Students were required to write appropriate questions for each branch displayed using the information presented. Students received one point for each correct question and contingent music for working.

Group III, trainee 3--coordinate geometry. This lesson was designed to introduce coordinate geometry to students. Students were required to connect a series of given points on a graph. When correctly connected the points formed the outline of a Christmas tree. Students received one point for each point and given points for their Christmas tree. Students also received contingent music for working.

Group III, trainee 4--filling out employment applications. Students were given the Visual Response System Sample Job Application Form and required to fill it out. Students were given one point for each section answered correctly and contingent music for working.

Group III, trainee 5--basic yellow cake mix. The objective of this lesson was to identify the ingredients and their functions in a basic yellow cake mix. Trainee 5 presented a list of ingredients and their function on the overhead projector. After one minute she covered various parts of the list and the students were required to write the covered response. Students received one point for each correct response and contingent music for working.

Group III, trainee 6--word bingo game. Students were given a bingo sheet containing sight words from the Dolch Sight Word List. Trainee 6 then played a tape of the Dolch Sight Word List and students were required to X out all words. The student who crossed out all their words first was considered the winner. One point was given for each word recognized and crossed out.

Group IV, trainee 1--basketball rules. Students were presented with the definitions of basketball rules to study. After all rules were disclosed, students were required to match specific terms with their definition. Students received one point for each correct answer.

Group IV, trainee 2--homonyms, synonyms, and antonyms. Students were presented with definitions and examples of each term. Slides of word pairs were then projected and students were required to identify whether they were antonyms, homonyms, or synonyms. Once all students had mastered this step, a list of words was projected for each type and students were

required to write appropriate antonyms, homonyms, and synonyms. Students received verbal feedback for the first exercise and one point for each correct word listed.

Group IV, trainee 3--writing a newspaper story. This lesson included two tasks: first, students were shown examples of the "specific to general" format used in newspaper writing. Students were then required to order various articles that had been cut-up into a cohesive article; second, students were given a list of facts and required to write an article.

Group IV, trainee 4--brass instruments. Using the overhead projector, students were shown brass instruments and their names. Students were then required to identify each instrument as it was disclosed. Students received one point for each correct answer.

Group IV, trainee 5--identifying fractions. Students were taught to identify numerators, denominators, and mixed fractions, by completing a series of sequenced worksheets. Students received one point for each correct answer.

Table 19 shows the attendance figures for all trainees in Groups I, II, and III. The drop in attendance for Group II was due to the Home Economics teacher missing five classes because she was required to shop for classroom supplies during inservice sessions.

Table 20 shows the composite results of the Visual Response System Inservice Questionnaire. Trainees felt they had learned the material covered during the inservice program. Strengths of the Visual Response System Inservice Teacher Training Program cited by the trainees were organization of materials and demonstration of the system. Weaknesses cited by the trainees were loss of their normal preparation period, and trainees in Group III felt their inservice program was too rushed. All trainees stated that they enjoyed the Visual Response System Inservice Teacher Training Program.

## Discussion

An inservice teacher training program was developed to teach those skills necessary to teach effectively in the Visual Response System. The Visual Response System Inservice Teacher Training Program was implemented and evaluated with three groups of teachers at a high school for juvenile male offenders. A fourth group of teachers was also trained after reseach and development of the inservice program was completed. This section is arranged in the following manner: first, suggested modifications in the Visual Response System Inservice Teacher Training Program are discussed; second, suggestions for further research on the Visual Response System Inservice Teacher Training Program are given; and finally, a summary of the Visual Response System Inservice Teacher Training Program is presented.

Table 19. Attendance figures for all Visual Response System Inservice Teacher Training Programs

| Trainee Number | Group I | Group II | Group III |
|---|---|---|---|
| 1 | 14/15 93% | 12/12 100% | 12/12 100% |
| 2 | 14/15 93% | 11/12 92% | 10/12 83% |
| 3 | 14/15 93% | 8/12 67% | 10/12 83% |
| 4 | 14/15 93% | 10/12 83% | 12/12 100% |
| 5 | 13/15 87% | 9/12 75% | 7/12 58% |
| 6 | 11/15 73% | 10/12 83% | 12/12 100% |
| 7 | 15/15 100% | - | - |
| Mean | 95/105 = 90.5% | 60/72 = 83.3% | 63/72 = 87.5% |

Table 20. Visual Response System In service Questionnaire Group I, II, III - 19 Trainees

1. I felt the strong points of the VRS in service were:

   Use of hardware - 10
   Lesson plan preparation - 7
   Precise instructions - 7
   Demonstration of equipment - 9
   Concrete examples, taught in VRS - 3

2. I felt the weak points of the VRS in service were:

   Need overview, no weaknesses, shut-down days broke continuity, more practice time, need more time

3. I felt the quizzes were:

   unfair - 1  generally fair - 6  always fair - 12

4. I felt the subject matter was presented:

   too slow - 1  just right - 13  too fast - 5

5. I feel I can operate all VRS hardware

   Yes - 18  No - 1

6. I feel I can produce my own software

   Yes - 19  No - 0

7. I feel I understand the following constructional techniques.

   reinforcement - 19
   token economy systems - 19
   remediation - 19
   generalization - 19
   disruptive behavior - 19

8. I feel I can prepare lesson plans for the VRS.

   Yes - 19  No - 0

9. I feel that it takes longer to prepare a lesson for the VRS than for the regular classroom.

   Yes - 11  No - 7  Uncertain - 1

10. I am looking forward to teaching the VRS?

    Yes - 17  No - 1  Neutral - 1

11. Overall, I am glad I participated in the VRS in service.

    Yes - 18  No - 1

    If no, why not? Did not like losing preparation period.

Additional comments/suggestions:

   need handbook - 1
   asset to BYC - 1
   hope teachers will use to help students - 1
   pretest too long - 1
   too rushed - 5
   objected to losing free period - 1

Additional comments/suggestions on VRS handbook:

   need to allocate teacher time to prepare - 2
   handy reference - 2
   systematic - 1
   need study quizzes at end of each section - 1
   need appendices - 2

Suggested Modifications in the Visual Response System Inservice Teacher Training Program

Modifications were made in the Visual Response System Inservice Teacher Training Program following suggestions of the trainees and the instructor. Now that all three groups have been trained, it is possible to suggest still further modifications to the inservice program.

Modifications fall under four general headings: (1) generalization of skills; (2) the inservice schedule; (3) trainee participation; and (4) use of the handbook.

Generalization of skills. Greenwood and Hops (1976) and Horton (1975) state that one way to avoid the nongeneralization of learned behaviors across settings is to train the behavior in the setting in which it must eventually be used. The Visual Response System Inservice Teacher Training Program did exactly this. But no data were collected on whether these behaviors generalized from the inservice to actual Visual Response System teaching situations with students. Horton (1975) states:

> "Apparently, the only way that a set of behaviors will appear under diverse sets of teaching conditions is when these behaviors are originally trained for all of these conditions and support of these behaviors (in the form of performance feedback) is programmed into each of these situations." (Page 317-318.)

In its present format, the Visual Response System Inservice Teacher Training Program permits trainees to practice in the Visual Response System with the other trainees serving as students. This is a different condition from practicing with actual students. Because of this, the inservice program should be modified to allow the trainees to practice and demonstrate their lesson plans with their own students. Feedback on trainee performance could be achieved in a number of ways (e.g., the Bug-in-the-Ear technique, Bowles and Nelson, 1976). This allows the instructor to deliver immediate feedback as well as verbal prompts to trainees as they practice their lesson plan. Also, at the end of each session the instructor could present the trainee with a written evaluation similar to the final lesson plan evaluation form. This evaluation could include both the positive aspects and those aspects of the trainee's performance which need to be practiced. It would also give the trainees a permanent product of their progress throughout the inservice program.

This modification would control for setting specific behaviors. All trainees would still be trained in the Visual Response System, as well as with their own students.

The inservice schedule. Because of the change from trainees as students to the use of actual students, the Visual Response System Inservice Teacher Training Program schedule will also need modification. Initial sessions in which the trainees are taught the effective use of the Visual

Response System hardware should remain the same. The teaching procedure of demonstration, practice, and evaluation was effective in teaching the use of the Visual Response System hardware. Therefore, it is recommended that these procedures be left as is. After this, the schedule should change however, and trainees should immediately begin to produce lesson plans and related software. Each trainee could be scheduled into the Visual Response System at least twice a week for the remainder of the inservice program. Regular inservice classes would be reserved for quizzes on readings from the handbook, time for trainees to plan their lessons, produce software, make modifications when necessary, and practice those skills that need polishing, as indicated by the performance evaluations conducted by the instructor in the practice sessions with students.

The extra time to prepare lesson plans and software during inservice sessions was one of the major concerns of the trainees as indicated on the Visual Response System Trainee Questionnaire. The extra time in the inservice sessions would also allow trainees to share ideas and an emphasis could be placed on developing more comprehensive instructional units.

A final suggestion in the scheduling of future Visual Response System Inservice Teaching Training Programs is to schedule the trainees into the Visual Response System for at least three weeks after the inservice program is over. During this time the instructor would make weekly follow-ups to provide feedback to the trainees and monitor the maintenance of learned teaching behaviors.

Trainee participation. English (1971), Hammons (1976), Heath (1974), Jarolimek (1970), Nagle (1972), and Polette (1973) all state the need to include the trainees in decision making and reward trainee participation in the inservice program. Rewards that can be used include release time to attend the inservice workshops, and reduction in outside duties to accommodate the time spent in the inservice program. Trainees should feel that they have a voice in the inservice procedure. The continued use of a questionnaire to gather information for further modification is recommended. Trainees should receive daily feedback in the form of performance evaluations and recognition when complete mastery of all inservice objectives are achieved. Therefore, the continued use of the Visual Response System Certificate is recommended.

Finally, although in some instances it will not be possible, college credit can be given for completion and mastery of the Visual Response System Inservice Teacher Training Program. College credit was not arranged until the third inservice session was begun but it proved to be the motivating force for at least one trainee to attend and master all objectives.

Use of the Visual Response System Handbook. With the addition of weekly practice sessions in the Visual Response System and the Visual Response System inservice class becoming more of a workshop for preparing lesson plans, the handbook would become a more important source of information concerning instructional techniques. Trainees should be given reading assignments in Teaching in the Visual Response System that cover

the specific instructional techniques, e.g., reinforcement, remediation, and generalization. At the beginning of each session for which reading was assigned, five-minute quizzes could be given covering the information presented in the reading. Trainees who master the quizzes would then be allowed to work on their lesson plans, while trainees who did not master the quiz would be required to participate in a remediation session covering the missed information. Following the remediation session another quiz could be given. This procedure would continue until all required material is mastered. Remediation should take no longer than 10 to 15 minutes and still allow the trainees at least 20 minutes of inservice class preparation time.

This method is recommended because the informal measurements taken during the Visual Response System Inservice Teacher Training Program indicate that the handbook, Teaching in the Visual Response System is at least as effective as the lectures in providing trainees with the necessary information.

## Suggestions for Future Research on the Visual Response System Inservice Teacher Training Program

This section includes suggestions for future research on the Visual Response System Inservice Teacher Training Program. Areas for future research include: (1) content; (2) generalization; (3) evaluation; (4) trainees; and (5) presentation methods.

Content. The present inservice program is based on a set of objectives that have no experimental validation. The set of objectives were developed through "educated guesses" as to what skills are necessary to teach effectively in the Visual Response System. Research is needed to identify those skills that are functionally related to student achievement in the Visual Response System.

Generalization. Under what conditions do skills acquired in the Visual Response System Inservice Teacher Training Program generalize to actual teaching situations? Do future inservices need to have teachers practice with students, or can the same behaviors be achieved with the other trainees acting as students? Research needs to be conducted to identify inservice conditions which facilitate the generalization of skills learned in the inservice program to actual teaching with students in the Visual Response System.

Evaluation. The evaluation procedures used by the project allowed for a descriptive assessment of the Visual Response System Inservice Teacher Training Program. With the present data it can be stated whether or not the trainees emitted the necessary behaviors. But does this change in teacher behavior change student behavior? Research needs to be conducted to measure change in student behavior as a function of the change in teacher behavior. A basic problem with research on this question is that most trainees will not have taught in the Visual Response System

prior to participation in the Visual Response System Inservice Teacher Training Program, making pre-post measures difficult or impractical.

Trainees. Research should be conducted with different types of trainees. Is the same inservice program suitable for all teachers? Will there need to be different inservice programs for teachers of the mildly handicapped (i.e., Educable Mentally Retarded, Learning and Behaviorally Disordered), teachers of the hearing impaired, trainably mentally retarded, etc.?

Research should also be conducted on the difference between preservice and inservice training. Will teachers who are exposed to the Visual Response System Teacher Training Program as part of their preservice training use the Visual Response System more than teachers who learn about it in an inservice setting?

Presentation methods. Research needs to be conducted on the length of time needed to conduct the Visual Response System Inservice Teacher Training Program. Should future inservice programs be longer or shorter, or is the present time table sufficient? What is the best format for presenting the information? Should the four major content areas be made into modules, complete with pre-posttests and instructional materials? Each trainee could be required to take the pretest and those who mastered the pretest would not have to complete the module. This would allow trainees to move through the inservice at their own pace. Before this is considered, however, the questions of skills which are functionally related to teaching effectively in the Visual Response System should be answered.

## Summary

This section of the final report has documented the development, implementation, and evaluation of the Visual Response System Inservice Teacher Training Program. As a direct result of the project, 19 teachers completed the Visual Response System Inservice Teacher Training Program.

The resulting Visual Response System Inservice Teacher Training Program can serve as a solid foundation and framework for future inservice teacher training programs on the Visual Response System. It provides a list of objectives with corresponding lesson plans for teaching each objective, as well as a procedure and time frame in which to present all objectives. The Visual Response System Inservice Teacher Training Program also includes a working draft of a handbook, Teaching in the Visual Response System, for use in inservice training. Suggestions for modifications and research on the Visual Response System Inservice Teaching Training Program were presented as well as limitations of the present inservice program and suggestions for future research.

# V. DISSEMINATION OF PROJECT ACTIVITIES

The eventual impact of any technology is a function not only of its proven usefulness and effectiveness but also of the awareness of its existence and capabilities by potential users. Thus, dissemination activities are an important facet of any program developing technology designed for use by others not directly participating in its development. In educational research, where the absence of a truly effective and systematic communication link to all potential users and the plethora of new ideas and programs vying for individual's attention make sharing new technology a difficult and sometimes competitive venture, dissemination efforts are particularly important. Since this project was involved in development of a technology entirely novel to most educators--when this project began the Visual Response System was unknown by most practitioners outside the specialty area of education of the deaf--a key objective was the communication of project activities and results to the educational community, especially to those professionals working with exceptional children.

This part of the final report describes the Visual Response System Demonstration Project's dissemination efforts. It is divided into six sections: (1) university affiliated research; (2) articles in professional journals; (3) presentations at professional meetings; (4) publicity and dissemination efforts in conjunction with the Ohio Youth Commission; (5) publicity via the news media; and (6) requests for information.

## University Affiliated Research

One doctoral dissertation (Cowardin, 1978) and four masters theses (Joynes, 1978; Marshall, 1979; Shadding, 1979; Test, 1978) were completed in conjunction with the project. Descriptions and results of these studies can be found in Parts III and IV of this report. Due to the continued support of the Visual Response System project by the Ohio Youth Commission (see Part VI), two more masters theses are planned for 1979.

## Professional Journals

### Journal Articles Published

Three articles describing the Visual Response System and project activities have been published in educational journals as a direct result of the project. These articles appeared in Exceptional Children

(Heward, 1978a), The Directive Teacher (Heward, 1978b), and the Journal of Special Education Technology (Heward, in press).

A fourth article (Heward and Eachus, in press) was accepted for publication by the Journal of Applied Behavior Analysis during the project year, however it is a report on the principal investigator's doctoral research conducted in the Visual Response System at the Boston School for the Deaf in 1974.

## Journal Articles Submitted

Four manuscripts describing project results are currently undergoing field review by four different educational journals. These manuscripts report on the results of a photosynthesis unit (submitted to Science Education), an employment application unit (submitted to the Journal of Reading), the Visual Response System inservice program (submitted to the Journal of Special Education Technology), and a general article on the use of the Visual Response System in correctional education (submitted to The Journal of Correctional Education). Complete copies of these manuscripts can be obtained by writing the principal investigator.

## Journal Articles in Preparation

Two manuscripts describing project research activities are currently in preparation. One is based on the self-management curriculum designed for and evaluated in the Visual Response System (Marshall, 1979). This article will probably be submitted to Behavioral Disorders. The second manuscript in preparation presents the results of the student-student interaction study. This article will probably be submitted to the Journal of Applied Behavior Analysis.

## Presentations at Professional Meetings

A 15-minute slide-tape show describing the Visual Response System and some of the projects' activities was developed and used as part of a presentation on the project. This presentation, including demonstration of a variety of Visual Response System instructional materials and techniques, was given at the Fourth Annual Convention of the Association for Behavior Analysis held in Chicago in May, 1978 and at the Technology and Special Education Conference hosted by Lewis University in August, 1978.

The project director and several members of the project staff are scheduled to make presentations on the Visual Response System and research results generated from it at the Fifth Annual Convention of the Association for Behavior Analysis to be held in Dearborn, Michigan in June, 1979, at the Annual Convention of the Correctional Education Association to be held in Ashville, North Carolina in July, 1979, and at the Ohio Federation

Council for Exceptional Children Annual Convention to be held in Columbus, Ohio in November, 1979.

## Ohio Youth Commission Publicity and Dissemination

The Ohio Youth Commission (OYC) made possible several dissemination efforts that the project could not have conducted on its own. The OYC printed approximately 500 copies of an 8-1/2" x 14" folding brochure on the Visual Response System project (see Appendix XII). To date, about 400 of the brochures have been distributed at conferences and to visitors to the Visual Response System at Buckeye Youth Center.

An open house was held at Buckeye Youth Center on June 1, 1978 during which the Visual Response System was demonstrated to 110 guests representing the Ohio State Department of Education, State Board of Education, Division of Mental Retardation and Developmental Disabilities, other Ohio Youth Commission institutions, and the Columbus Public Schools, guests were shown the slide-tape show, and then, in groups of eight, they took part in a demonstration lesson in which each visitor can actively participate in the Visual Response System as a student would. This demonstration lesson was specially prepared by project staff to illustrate some of the instructional capabilities of the Visual Response System.

Since the open house, at least 100 more people, primarily university students and administrators and teachers from area school districts have visited The Buckeye Youth Center Visual Response System and participated in the demonstration lesson.

## News Media

All three Columbus network television stations (WCMH-Channel 4, WTVN-Channel 6, and WBNS-Channel 10) independently filmed and broadcast on the evening news a segment on the Visual Response System project. Each of these film clips ran about two minutes in length. Warner Brothers Qube television broadcast a longer, more in-depth (about 7-minutes) story on the Visual Response System project on their evening news magazine program "Columbus Alive." Also the project director was a guest on an educational program broadcast by WOSU (Channel 34, public television) during which the Visual Response System project was discussed.

Local newspaper coverage of the project was provided by the Columbus Dispatch which ran an article describing student reactions to the Visual Response System (see Appendix XII).

## Requests for Information

To date the project has received numerous written requests for information (e.g., cost, construction plans, research results) on the Visual Response System beyond that which has appeared in journal articles. Most of the requests have come from public school administrators and directors of special education, a few have been received from university-based researchers. One request was received from Australia and one from the U.S. Department of the Interior, Bureau of Indian Affairs, Alaska. Persons writing for information received a letter from the project director stating that an information package on the Visual Response System (to be distilled from the final report) will be compiled and mailed to them when completed.

# VI. SUMMARY AND FUTURE RESEARCH NEEDS

This section of the final report summarizes project accomplishments, describes activities to continue and expand work with the Visual Response System begun by the project, and suggests some needed areas for future research and development of the Visual Response System.

## Project Accomplishments

Project staff, with cooperation and assistance from the Ohio Youth Commission, constructed and 8-student Visual Response System classroom (see Fig. 1, p. 3) at Buckeye Youth Center, 2280 West Broad Street, Columbus, Ohio. The Visual Response System was operational on May 1, 1978 and was employed by Buckeye Youth Center faculty and project staff as a resource room for students at the facility for the final eight months of the project. (Initial construction delays caused the project to request a three-month no-cost extension which was granted to allow for the completion of several evaluation studies.)

### Instructional Evaluation

A total of seven Visual Response System teaching programs were developed and empirically field tested as part of the project. The seven programs covered a wide range of academic subject areas--writing (composition and punctuation), spelling, math (fractions), science (photosynthesis), and functional reading (completing employment applications)--and one focused on social behavior (specification and management of one's own behavior). Evaluation of each program's effectiveness was based on repeated measures of students' performance of the skills each program was designed to teach. That is, how quickly and how well did students acquire the skills the program sought to teach.

As a general conclusion, it can be stated that secondary mildly handicapped students (educable mentally retarded, learning disabled, and behavior disordered) can learn a wide range of academic skills in the Visual Response System. In every program evaluated, all students performed better after receiving Visual Response System instruction than they did before entering the program. In the spelling program, and in some aspects of the composition and math programs, student progress and/or maintenance of learned skills was not particularly impressive. However, much was learned from these initial evaluations, and modifications in the composition and math programs should improve their effectiveness and efficiency. Questions were raised as to whether the spelling program developed is both

effective and appropriate for secondary students--maintenance was low and the activity was too time consuming.

The employment application, photosynthesis, and self-management programs all produced very positive results which support the motion that the Visual Response System can be used to present complete units or short courses to high school students. The three programs covered subject areas that previously had not been presented in the Visual Response System.

Approximately 125 students at Buckeye Youth Center received some instruction in the Visual Response System during the project year, as part of either staff-taught or regular faculty-taught classes. Of all the students who received instruction in the Visual Response System, 52 were interviewed using a standardized questionnaire consisting of nine questions asking their reactions to and feelings about the Visual Response System. (Student and project staff schedules made it impossible to interview all students who had classes in the Visual Response System.) A summary of the student interviews shows students are extremely positive about the Visual Response System (see pp. 94-97).

## Inservice Training

An inservice training program designed to provide teachers with skills to teach effectively in the Visual Response System was developed and modified several times during the project. A total of 24 teachers at Buckeye Youth Center completed the 12-session inservice program. Participants demonstrated they could operate all Visual Response System hardware, deal with minor maintenance problems, and prepare and present instructional materials in the Visual Response System.

## Dissemination of Project Activities

Dissemination of project activities was, and continues to be, accomplished in a variety of ways. To date, four articles on the Visual Response System project and research generated from it have been published in educational journals and six more have either been submitted to professional journals or are in preparation. One Ph.D. dissertation and four M.A. theses were written from research conducted within project. The three Columbus network television stations, Warner Brothers Qube, and the local public television station all filmed and broadcast pieces on the Visual Response System project. An open house was held in conjunction with the Ohio Youth Commission and visitors are continually being given demonstrations of the Visual Response System classroom.

## Current Status and Future Development of the Visual Response System

At present, the Visual Response System at Buckeye Youth Center is receiving regular use by a small number of teachers (4-6). Teachers report

two major obstacles limiting their regular use of the room. First, many of the teachers have more than eight students per class period. While some teachers have had as many as 9 or 10 students in the Visual Response System (with the extra students sharing the overhead projectors with students seated at the ends of the horseshoe), such an arrangement is cumbersome and limits the type of lesson and activity that can be accomplished. Since the Visual Response System at Buckeye Youth Center is not staffed by a full-time resource teacher, as would a typical resource room, the regular teachers are responsible for managing the instruction for all students assigned to them each period.

The second major problem restricting regular use of the Visual Response System is curriculum materials. Some Visual Response System teaching units and activities were developed as part of this project, but they represent a very small percentage (e.g., math fractions, employment applications, photosynthesis, etc.) of the skills comprising a secondary curriculum. While teachers at Buckeye Youth Center were taught the basic techniques necessary for preparing instructional software for the Visual Response System during the inservice program, the time required to plan and develop materials for a well-paced Visual Response System lesson is greater than the time required to prepare teaching materials and activities for a similar lesson in the regular classroom. Most teachers report the demand of additional preparation time as too great.

It appears that at least two things must happen before the Visual Response System could take its place as a legitimate and effective instructional resource in most schools. First, the Visual Response System must be utilized and staffed as a resource room. A resource room teacher, highly skilled in teaching in the Visual Response System, could work in the Visual Response System with small groups of students from one or more classrooms. If the regular classroom teacher wanted to use the Visual Response System, the resource teacher could work with the teacher's remaining students. (In schools with teacher's aides, the problem of managing additional students is easily solved. The regular classroom teacher could work with a group of students in the Visual Response System, while the aide works with the remaining students. Or, classroom aides and volunteers could conceivably be taught to implement well-designed teaching activities in the Visual Response System.)

Second, a curriculum of Visual Response System materials and activities must be developed and made available to teachers who are expected to use the room. This curriculum should at least cover the basic academic tool subjects for which resource rooms are most often employed. A well-paced Visual Response System lesson can require a great deal of software, even for one 40-minute period. Most teachers do not have the time to develop such materials. If Visual Response System instructional materials and activities were available for a basic curriculum, classroom teachers or the Visual Response System resource teacher could make the modifications necessary to meet specific skill deficiencies of certain students.

## Expansion of the Visual Response System Project by the Ohio Youth Commission

Recognizing the need to assist teachers in preparation of Visual Response System teaching materials the Ohio Youth Commission funded two Graduate Research Associate positions through The Ohio State University for the 1978-79 academic year. These two half-time appointments have been filled by M.A. candidates in the Faculty for Exceptional Children. These two students are working closely with several teachers at Buckeye Youth Center, developing software for use by the teachers in the Visual Response System.

In addition, the Ohio Youth Commission, responding to the positive evaluations of the instructional effectiveness of the Visual Response System at Buckeye Youth Center and the favorable reaction to the Visual Response System by teachers, students, and the administration of the school, has funded the construction of Visual Response System classrooms in three more of their institutions--Scioto Village for Girls, TICO in Columbus, and Fairfield School for Boys in Lancaster, Ohio. These three Visual Response System classrooms are currently under construction as part of a new project which also includes an inservice training component for teachers at all three schools. This entire project is funded by the Ohio Youth Commission.

## Other Uses and Developments

This project was not able to determine the extent to which other Visual Response System classrooms around the country are being utilized. Approximately 10 residential schools for the deaf acquired and began to use Visual Response System classrooms as a result of efforts by the Northeast Regional Media Center for the Deaf (University of Massachusetts) during 1968-1974. The director of this project communicated with administrators and teachers at the Tennessee School for the Deaf (TSD), Knoxville, Tennessee and the Model Secondary School for the Deaf (MSSD), Washington, D. C. several times during the project year. Both TSD and MSSD are operating 10-student Visual Response System classrooms on a daily basis. The Visual Response System at the Tennessee School for the Deaf is used by the Primary Deportment for language development activities. The brand new Visual Response System at MSSD (completed March, 1979) is currently being used to a great extent for foreign language instruction.

Communication with faculty and administrators at TSD and MSSD led to the development and submission of a grant proposal to the Personnel Preparation Division of the Bureau for Education of the Handicapped (BEH). The proposal describes a project which would provide an inservice training program on the Visual Response System to teachers at both schools. A funding decision on this proposal had not yet been made at the time this report was written.

Two other proposals for projects extending research and development of the Visual Response System have also been submitted to BEH. One

proposes a model program for integrating mildly handicapped students into the regular classroom using a Visual Response System as a resource room, the second proposes the demonstration and evaluation of a Visual Response System classroom utilizing the DTIMS curriculum (Stephens, 1976) in an elementary school. Funding decisions on these two projects are also awaited.

## Research and Development Needs

While data describing changes in student performance in the Visual Response System indicate it can be an effective learning environment, a great deal of research remains to be done. This section describes areas of research and development on the Visual Response System that are viewed as critical if the concept is to ever be utilized to any extent.

1. Cost effectiveness. A series of well-controlled studies comparing student learning in the Visual Response System with comparable teaching methods (as close as possible) in the regular classroom is needed. Such comparative experiments were beyond the work-scope of this project but are needed to determine the relative cost-effectiveness of the Visual Response System.

2. Scheduling/staffing. At present it is not clear how to integrate a Visual Response System classroom into the overall staffing and scheduling plans of a school program in order to achieve optimum results. While the Visual Response System is probably best employed as a resource room, none of the schools which currently operate a Visual Response System classroom have a resource teacher specially hired and trained to manage it. Also, the grouping and scheduling of students into Visual Response System class periods must be studied to determine the most effective procedures.

3. Curriculum. Lack of Visual Response System instructional materials and activities is seen as the biggest impediment to higher rates of utilization of existing Visual Response System classrooms and to adoption of Visual Response Systems by other schools. While teachers can effectively use the Visual Response System to drill students on certain skills with a minimum of software preparation, Visual Response System lessons designed to help students acquire new skills often require large amounts of materials. It is unrealistic to expect most classroom teachers to be willing and able to plan and develop those materials in addition to their everyday teaching duties. It is recommended that a project be initiated to develop and evaluate curricular materials specially designed for the Visual Response System.

4. Generalization. This project collected a small amount of data on students' ability to perform in the regular classroom, skills

they had learned in the Visual Response System (e.g., employment applications, math fractions, photosynthesis). These data indicate that such generalization does occur. However, the situations in which generalization was measured in these studies required students to make the very same responses (except for the generalization measure on completing employment applications) as they had in the Visual Response System, only the setting was different--the regular classroom. Another type of generalization that is required of students if they are to make the most of skills acquired in a resource room is the ability to use those skills in other learning situations and activities in the regular classroom, e.g., using math fractions to help plan a budget. Studies should be conducted to measure the extent of this type of generalization.

In addition to descriptive studies on generalization, a research program should be initiated in an attempt to determine the variables controlling generalization from the Visual Response System to the regular classroom. If such functional relationships can be identified, strategies to increase the likelihood of generalization could be communicated to the teachers (both the Visual Response System and regular classroom teacher) involved.

5. Student-student interaction. The projects' study on student-student interaction objectively verified what had been noted informally in the past by teachers in the Visual Response System --students imitate, or incorporate into their work, responses made by other students when visual access to their peers' work is available, i.e., the overhead projectors are "on." However, this initial study of student-student interaction in the Visual Response System was merely descriptive. It compared the extent of student-student interaction in the Visual Response System with a non-Visual Response System (overheads "off") learning environment. A series of additional studies should be planned and carried out in an attempt to identify controlling variables in addition to visual access, e.g., student characteristics, type of responses being emitted, role of reinforcement, etc. As with the proposed experiments on generalization, should functional relationships be demonstrated between student-student interaction and a given set of variables that can be teacher controlled, teachers could then manipulate student-student interaction in lessons and instructional activities in which it would enhance learning. This research would also add much needed data to our basic understanding of imitation and social modeling phenomena.

6. Inservice training. Work must continue toward improving both the effectiveness and the efficiency of inservice teacher training on the Visual Response System. At present, a Visual Response System inservice training proposal is under review by the Personnel Preparation branch of BEH. Specifically, this proposed project would develop and evaluate a canned, mediated inservice

training program, broken down into modules on units of instruction covering a related group of skills, e.g., local production of software. Such an approach promises at least two advantages. First, individual school programs, or even individual teachers, could conduct their own Visual Response System inservice training without having to rely on outside consultants. Second, a module approach would allow teachers who already possess the skills in a given module to skip that module and move ahead to the next unit of instruction.

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# APPENDIX I

## Maintenance Materials

MAINTENANCE LOG

DATE_____

NAME_____DATE_____LENGTH OF SESSION_____

SUBJECT_____ CIRCLE NUMBER OF STUDENT DESKS USED 1 2 3 4 5 6 7 8

STATE APPROXIMATE LENGTH OF TIME USED-

TEACHER OHP _____ FILMSTRIP PROJECTOR _____

STUDENT OHP _____ SLIDE PROJECTOR _____

ALL EQUIPMENT WORKING _____ NOT WORKING _____

PROBLEM _____

_____

_____

MAINTENANCE LOG

DATE_____

NAME_____DATE_____LENGTH OF SESSION_____

SUBJECT_____CIRCLE NUMBER OF STUDENT DESKS USED 1 2 3 4 5 6 7 8

STATE APPROXIMATE LENGTH OF TIME USED-

TEACHER OHP _____ FILMSTRIP PROJECTOR _____

STUDENT OHP _____ SLIDE PROJECTOR _____

ALL EQUIPMENT WORKING _____ NOT WORKING _____

PROBLEM_____

_____

_____

MAINTENANCE LOG

DATE_____

NAME_____DATE_____LENGTH OF SESSION_____

SUBJECT_____CIRCLE NUMBER OF STUDENT DESKS USED 1 2 3 4 5 6 7 8

STATE APPROXIMATE LENGTH OF TIME USED-

TEACHER OHP _____ FILMSTRIP PROJECTOR _____

STUDENT OHP _____ SLIDE PROJECTOR _____

ALL EQUIPMENT WORKING _____ NOT WORKING _____

PROBLEM_____

_____

# APPENDIX II

## Employment Application Materials

# VRS APPLICATION FOR EMPLOYMENT

PLEASE PRINT

**PERSONAL**

| Name | Last | First | Middle | Date |
|---|---|---|---|---|
| | | | | |

| Date of Birth | Age | Social Security Number | Sex |
|---|---|---|---|
| | | | ☐ M ☐ F |

| Married ☐ Yes ☐ No | No. of Dependants ___ | Weight | Height |
|---|---|---|---|
| | | | |

| Are you a citizen of the U.S.? | Phone No. |
|---|---|
| | |

| Present Address | No. | Street | City | State | Zip Code |
|---|---|---|---|---|---|
| | | | | | |

| Previous Address | No. | Street | City | State | Zip Code |
|---|---|---|---|---|---|
| | | | | | |

**PHYSICAL**

Do you have any physical disabilities? _____ If yes, describe _____

Have you had any major illness in the past 5 years? _____
If yes describe, _____

In case of an emergency notify,
Name Address Phone No.

**EDUCATION**

| | Name of School | Attended From - To | Did you graduate |
|---|---|---|---|
| Elementary | | | |
| High School | | | |
| College or University | | | |
| Other | | | |
| Other | | | |

## EDUCATION

Do you plan to continue your education? _____

Last Grade Completed _____ Grade Point Average _____

Extracurricular Activities _____

List any special office skills that you have? _____

## EMP. HISTORY

List below your last three employers:

| | Name and Address | Salary | Position | Date From - To |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

## MILITARY

Have you ever served in the U.S. armed forces? | Yes | | No

If yes, what branch _____

Dates of Duty _____ From _____ To

Rank at Discharge _____

## REFERENCES

List below three names of people not related to you, whom you have known at least one year.

| | Name | Address | Phone No. | Years Acquaintec |
|---|---|---|---|---|
| 1 | | | | |
| 2. | | | | |
| 3. | | | | |

Do you have any relatives in this company? _____

## JOB PREFERENCE

Type of work desired _____

Date available _____ Hours Available _____

Starting Expected Salary _____

Why do you want this job? _____

## GENERAL INFORMATION

Have you committed any felonies or violations? _____

If yes, explain _____

Are you a licensed driver? Yes ☐ No ☐

List here any additional comments that you think are important to us in considering you for employment: _____

## SIGNATURE

To the best of my knowledge the above statements are complete and are true. False statements may be cause for dismissal.

Signature _____

Date _____

Table 2

Training Sequence Employed for Each Set of Employment Application Items

| Step | Teacher Materials | Teaching Procedure | Students Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 1 | Master Item Transparency | All student OHPs "off". Teacher discloses one item at a time in random order. After all students have responded to each item, teacher turns "on" student OHPs. After feedback, student OHPs are turned "off" and another item is revealed. | Master Item Student Response Slides | Students match the projected item by placing a response slide on their OHPs. | 1 point delivered for each correct response. Students who incorrectly match the projected item, are required/helped to locate the correct response slide and place it on their OHP. No point given for remediation. |
| 2 | Variation Item Transparencies | Same as Step 1 | Master Item Student Response Slides | Same as Step 1 | Same as Step 1 |
| 3 | Master Item Transparency | Same as Step 1 | Personal Information Student Response Slides | Same as Step 1 | Same as Step 1 |
| 4 | Variation Item Transparencies | Same as Step 1 | Personal Information Student Response Slides | Same as Step 1 | Same as Step 1 |

Table 2 (continued)

Training Sequence Employed for Each Set of Employment Application Items

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 5 | Master Employment Application Transparency | Teacher points to items on the Application Transparency in random order. | Personal Information Student Response Slides | Same as Step 1 | Same as Step 1 |
| 6 | Master Item Transparency | Same as Step 1 | Master Employment Application Transparency | Students locate and point to the item on the Master Employment Application Transparency which matches the item projected by the teacher. | 1 point delivered to each student for each correct response. Students who point to an incorrect item are required/helped to locate correct item. No points given for remediation. |
| 7 | Master Item Transparency | Same as Step 1 | Lined Student Response Transparency and OHP marking pen. | Students print their personal biographic information as required by each projected item. | 1 point delivered to each student for the correctly printed response to an item. Students who respond incorrectly are given individualized |

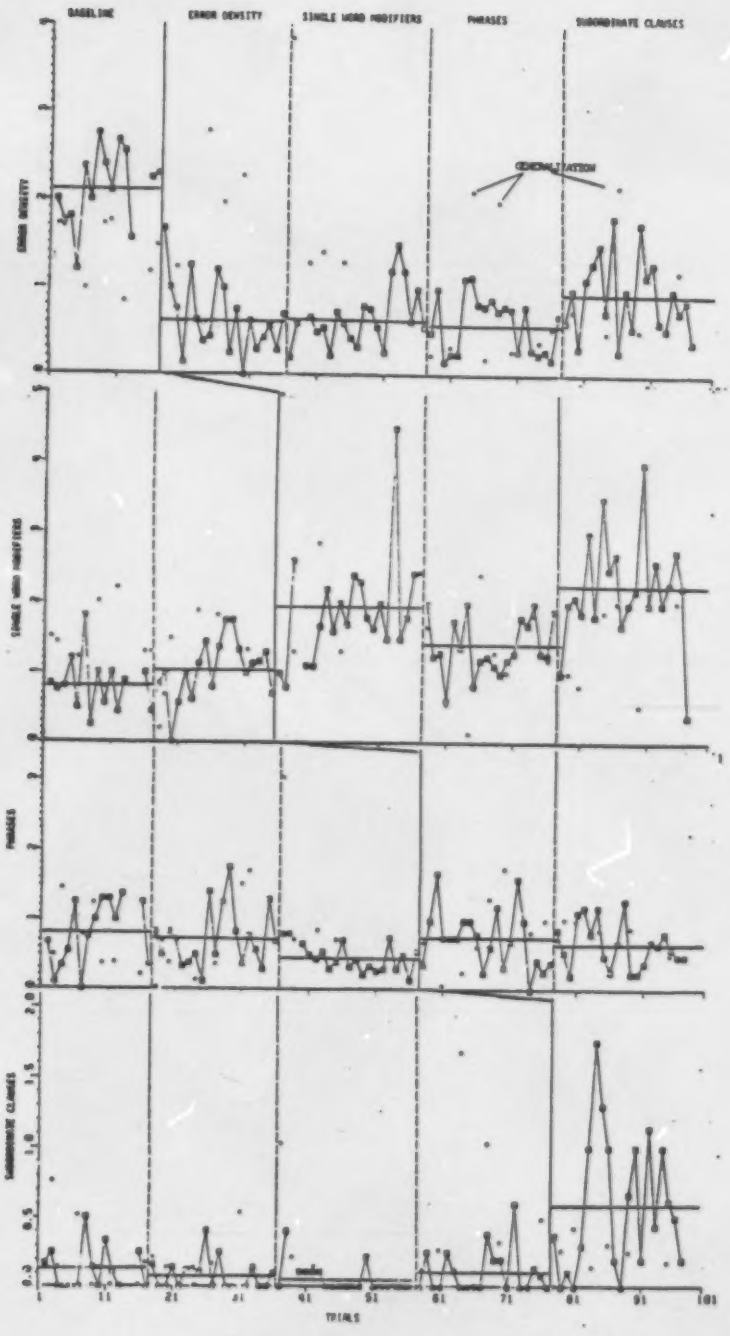
Table 2 (continued)

Training Sequence Employed for Each Set of Employment Application Items

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 7 (cont.) | | | | | remedial feedback verbally over the intercom plus visual remediation on the teacher's OHP when necessary. No points are given for remediation. |
| 8 | Variation Item Transparencies | Same as Step 1 | Lined Student Response Transparency and OHP marking pen. | Same as Step 7 | Same as Step 7 plus teacher gives verbal feedback for neatness. |
| 9 | None | Instructs students to complete those items on the Master Employment Application Transparency on which training has been conducted, including items from previous sets. Student OHPs "on" during entire Step. | Master Employment Application Transparency and OHP marking pens. | Students complete Master Employment Application Transparency with personal biographic information. | Same as Step 8 |

# APPENDIX III

## Compositional Materials




Multiple baseline graph of error density, single word modifiers per T-unit, phrases per T-unit and subordinate clauses per T-unit (Subject 1)

# APPENDIX IV

## Punctuation Materials

## Quotations

Use quotation marks only when you use the speaker's exact words.

He said, "The Martians are coming."

He said that the Martians are coming.

She said, "I have a pet dog."

She said that she had a pet dog.

"I have a pet dog," she said.

She said, "My dog's name is Moose."



" 10

1. Leave me alone she said.

2. Ray said that he hated his job.

3. The unprepared student hesitated and said I'm not sure.

4. I'll be back on Monday the electrician promised.

5. I asked my mother whether she ever gets tired of my little brother.

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6. Sometimes she said.

7. When the fire started I ran down the hall and shouted fire.

180

8. Bobby's mother said don't do that.

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## Possessives

Use apostrophes!

(Remember: There must be an owner and something owned.)

The boy's dog ran.

The teacher's lunch is in that bag.

My sisters' coats were on the chair.

The car's brakes are bad.





## Plurals

Just use an "s", with no apostrophe.

The boys ran.

The teachers ate lunch.

My sisters were sitting on the couch.

The cars are moving very slowly.

1. The (apartments, apartment's) messiness upset Edna's husband.

2. All the (floors, floor's) were dirty.

3. Her (husband's, husbands) complaints made Edna angry.

4. The (neighbor's, neighbors) heard their quarrels.

5. The (neighbor's, neighbors) dog began to bark.

6. The (dogs, dog's) barks irritated Sam.

7. A (cat's, cats') cries were heard in the alley.

8. Four (teacher's, teachers') cars were washed for free by their students.

9. That (store's, stores') prices are outrageous.

10. The (bicycle's, bicycles') tire is flat.

11. Most of the (worker's, workers') cars were parked in front of the building.

12. His (driver's, drivers') license was suspended for thirty days.

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# APPENDIX V

## Spelling Materials

forward

article

library

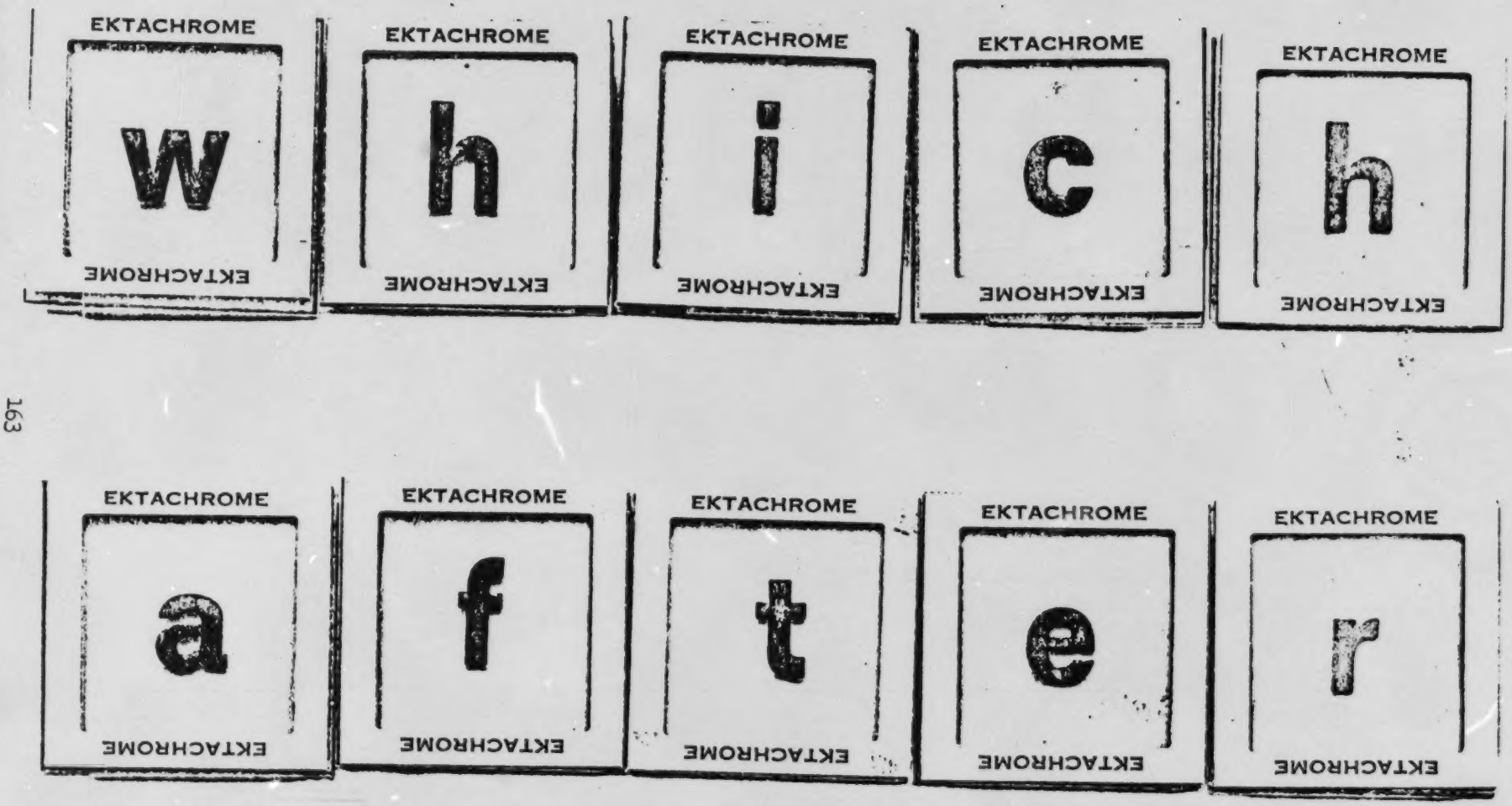
approval

1. This is the latest news bulletin.

2. It costs exactly $4.95.

3. The goods will be shipped by freight.

4. There are a considerable number of people in attendance.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Teaching Procedure for Spelling Unit

| Step | Teacher Material | Teaching Procedure | Student Material | Student Response | Feedback |
|---|---|---|---|---|---|
| 1 | Transparency of 4 spelling words, each used in a sentence. | Teacher progressively disclosed each sentence asking student to read aloud. | None | Student read sentence aloud. | Verbal praise. |
| 2 | Transparency of 4 spelling words in isolation. | Teacher disclosed spelling word 1. | Letter response slides. | With student OHP's on, student selected letters and arranged on OHP to match word presented by teacher. | Verbal praise and points. |
| 3 | Same as Step 2. | Teacher asked students to scramble letters on OHP and reorganize using teacher transparency as model. | Same as Step 2. | With student OHP's on, students scrambled letters on OHP stage then sequenced to spell modeled word. | Same as Step 2. |
| 4 | None | Teacher asked students to scramble letters on OHP then spell same word as presented in Steps 2 and 3. | Same as Step 2. | Students scrambled letters on OHP stage then with OHP's off students arranged letters to spell word 1. | Same as Step 2. |
| 5 | Same as Step 2. | Repeated Steps 2-4 for words 2, 3, and 4. | Same as Step 2. | Repeated Steps 2-4 for words 2, 3, and 4. | Same as Step 2. |
| 6 | Same as Step 2. | Teacher disclosed spelling words one at a time. | Twenty line transparency. | A. With student OHP's on students copied word presented on teacher OHP onto line 1 of transparency. | Same as Step 2 if correct and continue to Step B. If incorrect student repeated Step A. |
| 7 | Same as Step 2. | Same as Step 6. | Same as Step 6. | B. Student copied word from line 1 four more times. | |
| 8 | None | Teacher pronounced each of the four spelling words in isolation and then in a sentence. | Four line transparency. | With OHP's off student wrote each word as presented. | Verbal praise and points for each correct word. |

# APPENDIX VI

## Mathematics--Fractions Materials

Fill in the missing number.

1) $\frac{\quad}{4} = 1\frac{1}{4}$

2) $6\frac{1}{2} = \frac{\quad}{2}$

3) $7\frac{3}{8} = \frac{\quad}{8}$

4) $5\frac{2}{5} = \frac{\quad}{5}$

5) $7\frac{3}{4} = \frac{\quad}{4}$

6) $\frac{\quad}{3} = 1\frac{2}{3}$

7) $5\frac{1}{5} = \frac{\quad}{5}$

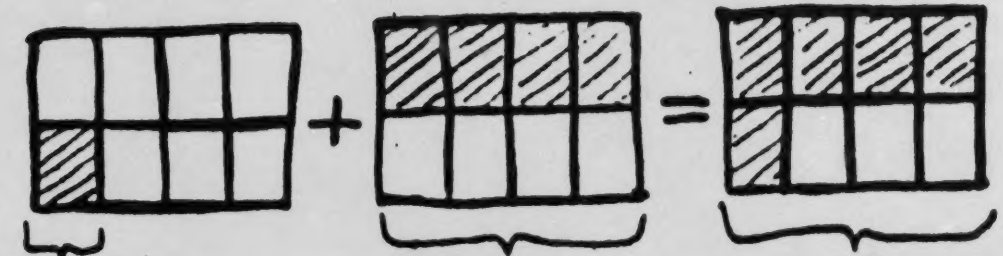
8) $\frac{\quad}{2} = 1\frac{1}{2}$

9) $2\frac{5}{6} = \frac{\quad}{6}$

10) $\frac{\quad}{5} = 2\frac{3}{5}$

# Adding Like Fractions

Problem: $\frac{1}{8} + \frac{4}{8} = \frac{5}{8}$ $\qquad \frac{1+4}{8} = \frac{5}{8}$

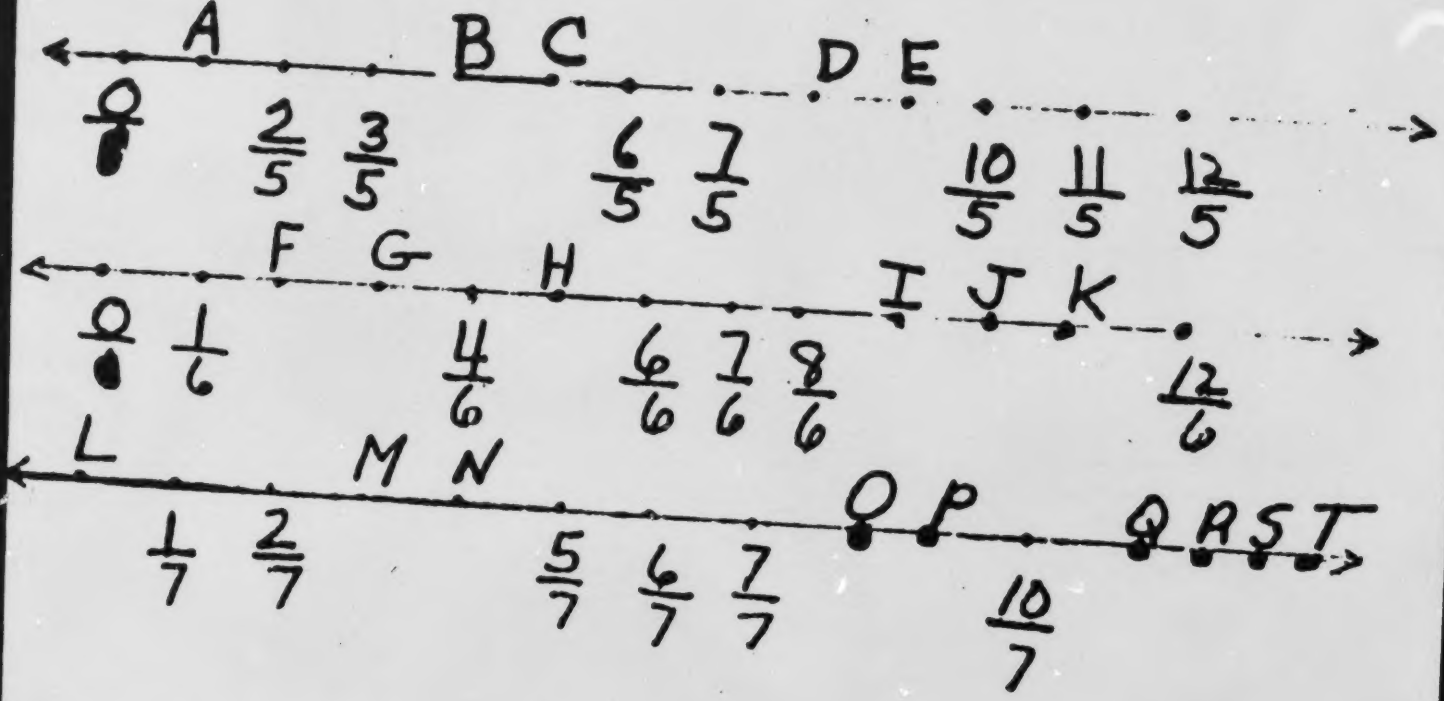


$\frac{1}{8} + \frac{4}{8} = \frac{5}{8}$

Examples: $\frac{4}{7} + \frac{2}{7} = \frac{6}{7}$ $\qquad \frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

$\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$ $\qquad \frac{7}{12} + \frac{2}{12} = \frac{9}{12} = \frac{3}{4}$

Write the correct fraction for each point labeled with a letter.



# Find the sums. Reduce to lowest terms when possible.

1) $\frac{5}{10} + \frac{2}{10} =$

2) $\frac{5}{9} + \frac{1}{9} =$

3) $\frac{3}{10} + \frac{3}{10} =$

4) $\frac{3}{16} + \frac{3}{16} =$

5) $\frac{3}{12} + \frac{1}{12} =$

6) $\frac{3}{6} + \frac{5}{6} =$

7) $\frac{5}{16} + \frac{7}{16} =$

8) $\frac{1}{5} + \frac{3}{5} =$

9) $\frac{2}{7} + \frac{3}{7} =$

10) $\frac{7}{9} + \frac{1}{9} =$

11) $\frac{9}{16} + \frac{3}{16} =$

12) $\frac{3}{4} + \frac{1}{4} =$

13) $\frac{4}{7} + \frac{1}{7} =$

14) $\frac{3}{5} + \frac{2}{5} =$

15) $\frac{3}{6} + \frac{1}{6} =$

16) $\frac{3}{4} + \frac{2}{4} =$

17) $\frac{1}{8} + \frac{2}{8} =$

18) $\frac{1}{3} + \frac{1}{3} =$

19) $\frac{4}{9} + \frac{1}{9} =$

20) $\frac{1}{7} + \frac{2}{7} =$

# APPENDIX VII

Science--Photosynthesis Materials

Table 2

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| Part I - Green Plants: Their Parts and Functions. | | | | | |
| 1 | Green plants, parts and functions transparency (T) | Project T. on overhead projector (OHP) using progressive disclosure, introduce topic. | None | None | None |
| 2 | Three parts of a green plant T. | Project in overlay fashion. When complete, teacher OHP is turned "off", a part is masked, and then teacher OHP is turned "on". After 10 sec student OHPs are turned "on". | Leaves, stem, and roots Response Slides. | Students place Response Slide corresponding to to part being masked. | 1 point delivered to each student for each correct response, incorrect responses remediated by referring students to correct projected images. No points given for remediation. |

Table 2 (continued)

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 3 | 5 plant T's. and answer T's. | Teacher projects plant T. after 10 sec teacher turns "on" student OHPs and gives feedback. | Leaves, stem, and roots Response Slides and student answer T. | Students place Response Slides in appropriate section of answer T. | Same as Step 2. |
| 4 | Post-test T. | All student OHPs "off". Post-test projected for 10 min. All student OHPs then turned "on" and feedback given. | Blank T on which to write answers. | Draw plant, label parts, and name functions of each part. | Same as Step 2. |
| Part II - Atoms and Molecules | | | | | |
| 1 | Atoms, molecules, and photosynthesis T. | Introduce topic. | None | None | None |

Table 2 (continued)

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 2 | T with problems, i.e., $C + O_2$ -- | Project T and show how atoms combine to make molecules. Turn student OHPs "on" and leave "on" while students work. | Write-on T. | Write symbols for molecules. | Same as Part I, Step 2. |
| 3 | A) T with explanation of numbers in $7H_2O$. B) 2 T's with problems. | A) Project in overlay fashion. B) Project T and turn "on" student OHP's, leave on throughout step. | A) None B) Student Response T. | A) None B) Write correct number of atoms and molecules in given chemical formulas. | A) None B) Same as Step 2. |
| 4 | $H_2O$ T, Atom T's and T's with 6 problems. | Project T and demonstrate how to make $H_2O$ using Atom T's. Student OHPs "on" while students work. | Atom T's, Student Response T. | Produce $H_2O$ molecule and write answers to problems. | Same as Step 2. |

Table 2 (continued)

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 5 | $CO_2$ T, Atom T's and T's with 6 problems. | Project T and demonstrate how to make $H_2O$ using Atom T's. Student OHPs "on" while students work. | Same as Step 4. | Produce $CO_2$ molecule, and write answers to problems. | Same as Step 2. |
| 6 | Photosynthesis equation T. | Project T and describe formula. | None | None | None |
| 7 | 1 problem T for $6CO_2$ and 1 problem T for $6H_2O$. | Project T's, student OHPs "on" throughout step. Give feedback as students work. | Same as Step 4. | Same as Steps 4 & 5. | Same as Step 2. |
| 8 | Photosynthesis eqaution T. | Project T and complete left side of equation with student aid. | None | State elements of equation. | None |

Table 2 (continued)

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 9 | 1 problem T for Glucose and 1 for $60_2$. | Same as Step 7. | Same as Step 4. | Same as Steps 4 & 5. | Same as Step 2. |
| 10 | Photosynthesis equation T. | Complete right side of equation with student aid. | None | State elements of equation. | None |
| 11 | Post-test T. | Turn "off" student OHPs and project T for 10 min. | Blank T. | Write answers. | Same as Step 2. |
| Part III - The Photosynthesis Cycle. | | | | | |
| 1 | T of photosynthesis equation and each chemical's function in cycle. | Project T. Same as Part 1 - Step 2. | Chemical symbol Response Slides and cycle function Response Slides. | Same as Part 1 - Step 2. | Same as Part 1 - Step 2. |
| 2 | T stating cycle. | Project T, turn "on" all student OHPs. Give feedback while students work. | Blank T. | Draw photosynthesis cycle. | Same as Part 1 - Step 2. |

Table 2 (continued)

Teaching Procedure Employed for Each Part of the Photosynthesis Unit

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| 3 | Post-test T. | Same as Part 1 - Step 4. | Post-test T. | Draw arrows properly connecting components of cycle. | Same as Part 1 - Step 2. |
| Part IV - Definition of Photosynthesis | | | | | |
| 1 | T with dictionary definition. | Project T, same as Part 1 - Step 2. | Photosynthesis Response Slides. | Same as Part 1 - Step 2. | Same as Part 1 - Step 2. |
| 2 | 3 fill-in-the-blanks T's with various components of the definition left out. | Project T. Turn "on" student OHPs. Give feedback. | Student Response T. | Write correct answers in corresponding boxes. | Same as Part 1 - Step 2. |
| 3 | Post-test T. | Turn "off" all student OHPs. Project Post-test T. Give feedback. | Blank T. | Write complete definition of photosynthesis. | Same as Part 1 - Step 2. |

# APPENDIX VIII

## Self-Management Materials

Topic: VRS System

Objective: Student will correctly answer questions on the Functioning of the VRS System

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| | | + | Demonstrate power to projectors; master & individual switches and student controls | Observe, turn own projectors on and off | projector on-off switch | visual |
| | | - | Demonstrate music and intercom through headphones, both as a group & individually. Combine music and intercom | Observe | | auditory |
| | | - | Demonstrate green light for correct answer red for incorrect. | Observe | | visual |
| | | - | Have ½ of students press call buttons while rest observe lights at teacher's console, then switch positions | Press button, observe | call button | visual |
| | | - | Administer points to all students. Then have them come to console to see teacher's counters | Observe | | visual |
| | | - | Point out "clear" bars, ask students to depress them | Depress "clear" bar | clear bar | visual |
| | | - | Point out screens, explain anti-keystoning | Observe | | visual |
| | on-off | + | Show several types of student response sheets on TOHP. Tell students to take response sheets out of folders. Allow to write with marking pens. | Write on response sheets | response sheets | visual |
| | on | + | Demonstrate erasing with solution tell students to erase their marks | Erase | solution, paper towel | visual |
| 1 | on-off | - + | Ture-False quiz | Write T or F for each | blank | 1 pt. each 6 tota |

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Curriculum: Self-Management

Topic: Introduction to Course

Objective: The student will sign a consent form and a contract agreeing to participate in the course and fulfill its requirement.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| | | - | Teacher introduces self. | Attend | | |
| | | - | Tell purpose of course; to teach skills in controlling own behavior by designing a program to change a behavior they select. | Attend | | |
| 2 | on-off | - | Tell basic theory: behavior is controlled by results. Give example. | Attend | | |
| | | - | Tell benefits of course: Will learn to control won behavior without control imposed by others. | Attend | | |
| 3 | | - | Pass out consent and contract forms. Briefly discuss the 10 assignments and the bowling trip to be won if 8 of 10 assignments are completed | Attend, sign consent and contract forms. | Consent & Contract Forms | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |

Topic: Selecting target behavior

Objective: Students will choose a target behavior to change during the course of instruction.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 4 | on-off | - | Tell 6 basic rules to select a target behavior. | Attend | | |
| 5 | on-off | - | Show example of unobservable vs. observable target behavior. | Attend | | |
| 6 | on-off | - | Show examples of too large, too small, and appropriate target behavior. | Attend | | |
| 7 | on-off | + | Show list of suggested behaviors to increase: Ask for more suggestions. | Attend, contribute examples | Blanks | See examples included in list. |
| 8 | on-off | + | Show list of suggested behaviors to decrease; ask for more suggestions. | Attend, contribute examples. | Blanks | See examples included in list. |
| 9 | on-off | -<br>+ | Put quiz on, tell time limit | write answers to questions | Blanks | Q 1 3 pts.<br>Q 2 2 pts.<br>Q 3 2 pts.<br>7 total |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Curriculum: ~~Self Management~~

Topic: Defining behavior

Objective: Students will give clear specific behavioral definitions of a behavior

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| | | - then + | Ask students to mark on a blank each time they see the teacher touch her nose. Explain that you must define the behaviors so that you know what to watch for. Different people have different ideas of what a behavior is, so they need a common definition. Give examples. Turn on SOHP to show the difference. Define touching nose together and try again. | 1 mark for each time teacher touches her nose. | Blank | See peers' responses |
| 10 | on-off | - | Tell 2 properties of a good definition. | Attend | | |
| 11 | on-off | + | Ask which definition of "sadness" is observable. | Write letter of the most observable definition | Blank | 1 pt. |
| 12 | prog. discl. | + | Say that unless definitions are detailed, they are too vague. Reveal lines of a definition 1 at a time, ask students to tell what the behavior is. | Write what they think the behavior is with each disclosure | Blank | See peers' responses |
| 13 | on-off | + | Ask students to select the best definition of several behaviors. | Write the letter of the best definition | Blanks | 1 pt. each 3 total |
| 215 | | + | Ask students to write a good definition of "paying attention." Write a good definition by synthesizing portions of responses | Write definition of paying attention" | Blanks | 1 pt. 216 |
| 14 | on-off | - + | Quiz | Write answers | Blanks | Q 1 1 pt. Q 2 2 pts. 3 total |
| 15 | on-off | - | Read assignment, pass out homework sheets | Return assignments next session | Homework sheets | |

Topic: Measuring target Behavior
Objective: Students will tell how to measure several target behaviors

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 16 | on-off | - | Describe 2 ways of measuring and the type of behaviors you would use each with. Give examples | Attend | | |
| 17 | progress. discl. | + | Tell students to put "timing" or "counting" slide on projector for each behavior. | Place "timing" on "counting" slides on stage. | Timing, counting slides | 1 pt. each 10 total |
| | | + | Ask students to give one behavior to measure by timing and one by counting. | Give one example of each | Blanks | 1 pt. each 2 total |
| 18 | on-off | - | Give examples of procedures for counting and timing. | Attend | | |
| 19 | on-off | - + | Tell students to separate the procedures into those for timing and those for counting. | Label "TIMING" and "Counting" at top of sheet write methods under correct labels | Blanks | 1 pt. each 5 total |
| 20 | on-off | - + | Quiz | Answer questions | Blanks | Q 1 4 pts. Q 2 1 pt. 5 total |

Curriculum: Self-Management
Topic: Recording behavior
Objective: The student will record an example of behavior on a recording form

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 21 | on-off | - | Demonstrate sample recording form; point out the 3 types of information it contains: behavior being measured, dates measured, and amount measured. | Attend | | |
| 22, 21 | on SOHP | - | Read example and record on Tr. 21 | Attend | | |
| 23 | on-off | + | Give another example. Ask students to record. | Record data points | Recording Forms | 1 pt. for behavior<br>1 pt. for recording data<br>1 pt. for recording data<br>3 total |
| 24 | on-off | -<br>+ | Quiz | Write answers | Blanks | Q 1 3 pts.<br>Q 2 2 pts.<br>5 total |
| 25 | | - | Handout assignment sheets | Record target beh. as homeword | recording sheets on paper | |

Curriculum: Self-Management

Topic: Review of defining, measuring, and recording

Objective: Students will answer qu-stions on defining, measuring, and recording correctly

| Tr. # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 26 | on-off | -- | Present review questions on defining target behavior. | answer questions | blanks | question 1 - 1 pt.<br>question 2 - 2 pts. |
| 27 | on-off | -- | Present review questions on measuring target behavior | answer questions | blanks | question 1 - 2 pts.<br>question 2 - 5 pts. |
| 28 | on-off | -- | Present review questions on recording. | answer questions | blanks<br>recording form | question 1 - 3 pts.<br>question 2 - 3 pts. |

Curriculum: Self-Management
Topic: Baseline
Objective: Students will take 1 week of baseline data on target behaviors.

| Tr# | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 29 | on-off | - | Define baseline and give reasons for taking baseline data. | Attend | | |
| 30 | on-off | + | Read example and ask students to record baseline observations only | Record baseline observations only | recording form | 1 pt. |
| 31 | on-off | -<br>+ | Quiz | Answer questions | blanks | Q 1 1 pt.<br>Q 2 1 pt.<br>2 total |

Topic: Graphing

Objective: Students will correctly label a graph and plot their data points

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 33 | on-off | - | Demonstrate simple graph form, explain that time goes across bottom, behavior up the side | Attend | | |
| 34 | on-off | - | Show example of behavior measured by timing. Behavior labelled as minutes. | Attend | | |
| 35 w/o over lay | on-off | - | Show example of graphing a behavior measured by counting Behavior measured by occurences. | Attend | | |
| 35 w/o over lay #1 & 36 on SOHP | overlay | - | Explain that plot data points by finding the date on the horizontal axis, then follow the line up until it is opposite the right amount of behavior. Demonstrate with 1st three points on Tr. 36 | Attend, plot the 3 data points as teacher does them. | simple graph form | |
| 35, 36 | overlay | + | Tell students to plot next 5 points on own. | Plot 5 data points | simple graph form | verify by placing 2nd overlay. 1 pt. for each correct pt. |
| 35 | write on | + | Draw dotted line to separate baseline & treatment phases label phases. | Draw dotted line & label phases | simple graph form | verify by comparing to teacher's |
| 35 | write on | + | Connect pt's. except across dotted line. | Connect pts. except across dotted line | simple graph form | verify by comparing to teacher's |
| 37 | on-off | - | Scale: explain that if working with high numbers on behavior axis, make each square worth multiple of a number. Give examples. | Attend | | |
| 38 | on-off | - | Scale: say that if using small numbers on the behavior axis, skip squares, or make each one worthwhile. Give examples | Attend | | |

Curriculum: Self-Management
Topic: Graphing, continued
Objective:

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 39 | on-off | -<br>+ | Quiz | Label graph and plot as indicated | simple graph | 1 pt. for labels<br>1 pt. for plotting data<br>1 pt. for dotted line<br>1 pt. for connecting dots<br>4 total |
| 40 | on-off | - | Hand out paper assignment sheets | Attend | | |
| | off | + | Help students plot data collected in their programs so far, remediate if necessary. | Plot data from own project. | advanced graph forms | remediate through intercom while others listen to music |

Curriculum: Self-management

Topic: Rewards

Objective: The students will tell an appropriate way of rewarding a behavior

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 41 | on-off | - | Say that when what you have done brings pleasant consequences, you're more likely to do it again. | Attend | | |
| 42 | on-off | - | Define reward | Attend | | |
| 41 | on-off | + | Ask students what the reward is in this case | write the reward | Blanks | see peers' responses |
| 43 | on-off | -<br>+ | Ask students which of several examples show a behavior being rewarded | write numbers of those that are rewards | Blanks | 1 pt. for each of 1, 2, and 5 |
| 44 | on-off | - | Say that rewards come after the behavior | Attend | | |
| 45 | write on | + | Ask students to list things that are rewarding to them. List these under the proper headings on Tr 45. | List rewards | Blanks | see lists included in Master list. 1 pt. if list 5 or more |
| 46 | on-off | -<br>+ | Quiz, part 1 | write answers | Blanks | Q 1 2 pts.<br>Q 2 3 pts. |
| 47 | on-off | + | Ask students to give rewards for several behaviors | write rewards | Blanks | 1 pt. each 3 total |
| 48 | on-off | - | Discuss amount of rewards | Attend | | |
| 49 | on-off | - | Explain that may set standards for reward by requiring more then or less than X behaviors for the reward. Give examples. | Attend | | |
| 50 | on-off | + | Give example; have students tell what the standard should be. | Set standard | Blank | 1 pt. |

Curriculum: ___ Self-Management
Topic: _____
Objective: _____

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 51 | on-off | -<br>+ | Quiz, part II | Write Answers | Blank | Q 1 - 1 pt.<br>Q 2 - 1 pt.<br>total of 4 |
| 52 | on-off | - | Hand out homework assignments. | Attend | | |
| 53 | on-off | - | Show list of possible rewards | Attend | | |

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Curriculum: Self-Management
Topic: Relief Rewards (Negative Reinforcement)
Objective:

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 54 | on-off | - | Define relief rewards and give examples. | Attend | | |
| 55 | Prog. discl. | + | Ask students to tell whether each is an example of a relief reward. | Tell "yes" or "no" | "yes" and "no" slides | 1 pt. each 3 total |
| 56 | on-off | + | Ask students to tell how each of 2 behaviors can be rewarded with a relief reward. | Write relief rewards | Blanks | 1 pt. each 2 total |
| 57 | on-off | + | Quiz | Write answers | Blanks | Q 1 - 1 pt. Q 2 - 2 pts. 5 total |

Curriculum: Self-Management
Topic: Interobserver agreement
Objective: Given an example, students will compute the percentage of agreement and plot the data.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 58 | on-off | - | Tell 2 students to record how many times you touch your nose during the presentation. Put definition of touching nose on another SOHP. | record touching nose | Blank | compare to peers' data |
| 59 | on-off | - | Give 2 reasons for taking interobserver measures. | Attend | | |
| | | + | Compare 2 student's data. | Attend | | |
| 60 | on-off | - | Outline the procedures for interobserver agreement. | Attend | | |
| 61 | on-off write-on | + | show how to Figure % of agreement. Work out class example | Attend | | |
| 62 | on-off | + | show another example, as.. students to compute the percent of agreements | Compute percentage | Blank | 1 pt. for set up<br>1 pt. for comput.<br>2 total |
| 63 | write on | - | Demonstrate method of graphing interobserver data points by using open circle. Use class example. | Attend | | |
| 63, 64 on SOHP | write on | + | Give another example, ask to find % agreement and plot. | Compute % agreement, plot data. | blank graph | 1 pt. for %<br>1 pt. for plot |

Curriculum: Self-Management

Topic: Interobserver continued

Objective:

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Material | Feedback |
|---|---|---|---|---|---|---|
| 65 | on-off | -<br>+ | Quiz | Compute percentage and plot | graph and blank | 1 pt. set up<br>1 pt. comput.<br>1 pt. labels<br>1 pt. Kris's data<br>1 pt. Tom's data |
| 66 | on-off | - | Hand out assignment sheets. | Attend | | |

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Curriculum: Self-Management
Topic: Punishers
Objective: The students will tell an appropriate punisher for each of several behaviors.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Material | Feedback |
|---|---|---|---|---|---|---|
| 67 | on-off | - | Tell 2 properties of punishers. Give examples. | Attend | | |
| 68 | on-off | + | Ask students to indicate whether each example is a punisher. | Write "yes" or "no" to each. | Blanks | 1 pt. each 5 total |
| 69 | on-off | - | Tell 2 ways to punish. Give examples | Attend | | |
| 70 | on-off | + | Ask students to tell which examples are "adding something bad" or "taking away, something good." | Write "A" or "B" | Blanks | 1 pt. each 3 total |
| 71 | on-off | + | Give examples of behaviors to decrease. | Give punisher for each | Blanks | 1 pt. each 4 total |
| 72 | on-off | - + | Quiz | Write answers | Blanks | Q 1 - 1 pt. each Q 2 - 2 pts. 6 total |
| 73 | on-off | - | Pass out assignment sheets. | Attend | | |
| 74 | on-off | - | List possible punishers | Attend | | |

Curriculum: [redacted]

Topic: Tokens

Objective: The students will give examples of tokens and back-up rewards, and set prices for back-ups.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 75 | on-off | - | Define tokens and back-up rewards | Attend | | |
| 76 | on-off | - | Tell advantages of token systems | Attend | | |
| 77 | on-off | + | Show examples | Tell whether each example is a token system. | Blanks | 1 pt. each<br>4 total |
| 78 | on-off | + | Give guidelines for choosing tokens. Ask students to give 1 more example of a token. Point out that money is also a token. | Give examples of a token | Blank | 1 pt. |
| 79 | on-off | + | Show list of back-up rewards. Ask students to give 2 more examples. | Give 2 examples of back-ups. | same blank | 1 pt. |
| 80 | on-off | + | Give guidelines for setting "prices" on back-ups. Say that "price" does not refer to money unless money is used for the token. Ask students to write price. | Write prices for back-ups | same blank | 1 pt. |
| 81 | on-off | -<br>+ | Quiz | Write answers | blank | Q 1 - 1 pt.<br>Q 2 - 3 pts.<br>Q 3 - 3 pts.<br>7 total |

Curriculum: Self-Management
Topic: Rewarding less often (intermittent rewards)
Objective: The students will tell how to reward a behavior intermittently.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 82 | on-off | - | Define intermittent rewards and give reasons for reducing the frequency of reward. | Attend | | |
| 83 | on-off | - | Tell 4 guidelines for decreasing the frequency of rewards. | Attend | | |
| 84 | on-off | - | Give example of method of reducing frequency of reward. | Attend | | |
| 85 | on-off | - | Give example in which frequency of reward was decreased too quickly. Tell how to remediate the situation. | Attend | | |
| 86 | on-off | - + | Quiz | Write answers | blanks | Q 1 - 1 pt.<br>Q 2 - 2 pts.<br>Q 3 - 2 pts.<br>5 total |

Curriculum: Self-Management
Topic: Review of reward, punish, relief rewards
Objective: The student will tell which of several examples are rewards, relief rewards, and punishers.

| Tr # | Method of Present | SOHP | Teacher Activity | Student Response | Response Materials | Feedback |
|---|---|---|---|---|---|---|
| 87 | on-off | - | define each type of consequence | attend | | |
| 88 | on-off | - | Reemphasize that consequences come after the behavior and only when the behavior happens. | attend | | |
| 89 | on-off | + | present questions | Fill in blank and tell T or F | blank | Q 1 - 2 pts.<br>Q 2 - 1 pt.<br>total 3<br>remediate w/ Tr. 88 |
| 90 | on-off | -<br>+ | Quiz | Write, R, RR, or P for each example | blank | 1 pt. each<br>5 pts. |

Self-Management Pre posttest

1. Write a clear, specific definition of "studying."

2. How would you measure each of these behaviors?

   Put counting or timing.

   a. Sleeping

   b. Smoking cigarettes

   c. Drinking milkshakes

   d. Watching TV

3. Circle the examples of rewards:

   a.. Rob catches a snake for his mother and she won't let him in the house.

   b. Tom turns in a paper he bought from the class cheat. His teacher gives it an "F".

   c. Junior washes the family car and his father lends it to him to take Lucy to the movie that night.

   d. After Tina does the dinner dishes, her mother gives her permission to go skydiving with her friends.

4. 4. Describe a good way to reward yourself for studying an extra hour.

5. Tom is measuring how many spiderman comic books he reads each day. Before he starts his program he measures for 3 days and finds that he reads 5, 8, and 6 comic books on those days. Then Tom starts donating a nickel of his allowance to his sister's Florida fund for each comic book that he reads. When he starts this program, he finds he reads 3, 2, 0, 2, and 1 over the next five days.

   Using this example, label the recording form below correctly and record these findings.

Behavior: _____

| | | | |
|---|---|---|---|
| Day _____ | Day _____ | Day _____ | Day _____ |
| Day _____ | Day _____ | Day _____ | Day _____ |

6. How many comic books did Tom read during each day of baseline?

_____

7. Plot the data from #3 on this graph and label it correctly.

8. Circle the examples of relief rewards:

   a. When Tom gets to class on time, his teacher tells him there will be no report made on him today.

   b. When Fred does his exercises every day for a week, he treats himself to a movie.

   c. When Lyle swears, he must give up his dessert for the day.

   d. When Mike brushes his teeth after dinner, his friends stop joking about his bad breath.

9. You want to stop biting your toenails. How could you punish this behavior?

10. Mike is timing how long he studies each night. One night he asks his roommate Bill to time his studying as a check on his data. Their findings are below:

| Days | Mike | Bill |
|---|---|---|
| 1 | 10 min. | |
| 2 | 15 min. | |
| 3 | 12 min. | |
| 4 | 20 min. | 10 min. |
| 5 | 15 min. | |

What is the percentage of agreement between Mike and Bill on Day 4? Plot both Mike's and Bill's data on the graph below:

11. Fred has been eating a piece of candy for every letter he writes to relatives. He now wants to start rewarding himself only after some of the letters he writes. How does he do this? Why might Fred want to do this?

12. True or False: Tokens are small objects or markers given right after a desired behavior happens and they can be traded in on something else later.

13. Larry wants to set up a token system to reward himself for asking good questions in class.

    a. What could he use as tokens? _____

    b. What are three back-up rewards he could buy?

    c. How much would each cost?

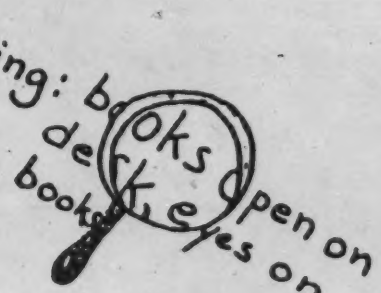
| Reward | Price |
|---|---|
| 1. | |
| 2. | |
| 3. | |

A good definition:

1. tells things you see or hear when the behavior happens. (Observable)

2. tells details.

(Specific)



Which can you <u>see</u> or <u>hear</u>? 11

1. Sad:
    a. tears on face.
    b. feeling lonely.
2. Giving compliments:
    a. making someone feel great.
    b. saying something positive about someone to their face.

12

What is the behavior?

Kneeling on the floor
with a sponge in your hand
spreading liquid wax.

Moving arms and legs
in time to the music.

Which is the best definition?

1. Smiling:
   a. Grinning.
   b. Curving corners of mouth up.
   c. Happy look on face.
2. Studying:
   a. getting homework done.
   b. concentrating on homework.
   c. eyes on book, writing answers to questions.
3. Cooperating:
   a. working near someone on the same project.
   b. being helpful.

# Quiz 2

(1 pt.) 1. The best definition of surfing is:

a. Riding waves on a long board.
b. Catching a curl.
c. Riding a wave in the ocean by standing on a long board being pushed ashore by the wave.

(2 pts.) 2. Give a clear, specific definition of "being late to class."

# Assignment

1. Choose a target behavior.

2. Define that behavior clearly and specifically.

Due Monday,
May 22

# APPENDIX IX

## Student-Student Interaction Materials

Teaching Procedures for Student-Student Interaction

| Step | Teacher Materials | Teaching Procedure | Student Materials | Student Response | Feedback |
|---|---|---|---|---|---|
| Part 1 (OHP's on) 1 | Random seating chart transparency. | Project transparency on overhead projector (OHP). | None | Students are to find their name and sit in the corresponding desk. | None |
| 2 | Teacher transparency containing the category title, 2 category words, sentences, and clue words. | Project transparency on OHP, using masking and progressive disclosure, introduce category title, words, and sentences. | None | Students are to read silently as it is read orally. | None |
| 3 | Same transparency as #2 stopwatch daily recording sheet. | Project same part of transparency as in #2. Turn music on and time 3 minutes. As students write, the teacher will record their category words on recording sheet. | Student response transparency containing ten numbered lines, non-permanent pens. | Students are to write sentences containing no more than 2 category words per sentence. | None |
| 4 | None | Stop the music and turn OHP's off for a second to signal that the trial is over, instruct students to circle their category words. | Same as #3. | Students are to circle each category word. | Teacher delivers points according to the reinforcement system. |
| 5 | None | Instruct students to pass in their response transparency. | Same as #3. | Students are to pass in student response transparency. | None |
| 6 | Same as #2 | Inform students to take out their clear transparency and put it on their OHP stage. | Clear transparency non-permanent pens. | Place transparency on OHP stage. | None |
| 7 | Same as #2 stopwatch. | Reveal the first clue word and time 3 minutes. | Same as #6. | Students are to decipher the word and write it on transparency. | Teacher checks for the first correct response and that student receives 1 point. |
| 8 | Repeat Steps 2-7 for Trials 2 and 3. | | | | |
| Part 2 (OHP's off) | Repeat Steps 1-8 except students use response sheets and pencils instead of transparencies. Students do not pass in response sheets at end of the trial. They circle their words and turn their sheets over. The teacher walks around the room to collect them. | | | | |

"Types of trees"

pine — Pine trees are common in the mountains.

oak — The oak tree has lost its leaves.

DAILY RECORDING OF NEW WORDS date:

Category: Words presented: OHP on _____ OHP off _____

| Names | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_1$ | | | | | | | |
| Total | | | | | | | |
| $T_2$ | | | | | | | |
| Total | | | | | | | |
| $T_3$ | | | | | | | |
| Total | | | | | | | |

Daily graph data

category:

New words $T_1$ $T_1$

date:

OHP on ——— OHP off ———

$T_2$ $T_3$

# APPENDIX X

Student Reaction Materials

Visual Response System

Student Evaluation Interview

1. Compare the VRS with your other classes.

   positive  negative  neutral

   Comment(s):

2. What did you like about the VRS?

3. What did you dislike?

4. How did you feel about having other students see your work?

   positive  negative  indifferent

   Comment(s):

5. Compare the difficulty of the work in the VRS to that of your other classes.

harder easier same

Why?

6. How did you feel about working for points?

positive negative indifferent

Comment(s):

7. Did you feel that you were competing with others in your class?

yes no sometimes

Was that good or bad?

8. Did the VRS keep you interested in your work better than other classes?

yes no sometimes

Why?

9. Did you enjoy having music to listen to while you worked?

positive negative indifferent

Comment(s):

APPENDIX XI

Visual Response System
Inservice Teacher Training Program Materials

-DAILY CHECKLIST-

1. Turn on master OHP switch.
2. Turn on all OHP's.
3. Turn off all OHP's.
4. Check red, green lights and points.
5. Clear points from teachers console.
6. Check student desks for points.
7. Clear points from student desks.
8. Check student call lights.
9. Turn on tape deck.
10. Rewind tape, if necessary.
11. Turn off tape deck.
12. Turn on intercom.
13. Turn off intercom.
14. TEACH
15. Place all intercom switches in middle position.
16. Turn off intercom.
17. Rewind tape.
18. Turn off tape deck.
19. Turn off individual OHP's.
20. Turn off master OHP switch.
21. Return all point switches to <u>off</u> position.
22. Return counters to zero (teacher's console).
23. FILL OUT TEACHER'S LOG.
24. CLEAR points from student desks.

-VISUAL RESPONSE SYSTEM INSTRUCTIONAL CHECKLIST-

Before Teaching

Step 1 Turn on master overhead projector (OHP) switch.

A) If all individual OHP lights are on go to step 2.
B) If an individual OHP light is not on:
   1) Ask student to turn OHP on
   2) Open and reclose OHP trap door
   3) If lights are still not on report problem in maintenance log

Step 2 Turn on all OHP's

A) If all OHP's are working go to step 3.
B) If OHP does not turn on:
   1) Flip lever to change bulb - if this works check other bulb, this is to double check

Step 3 Turn off all OHP's - leave master switch on

Step 4 Check red and green lights and give a point to each desk.

A) If okay - go to step 5
B) If lights or point do not work report in maintenance log

Step 5 Clear points from teacher's console.

Step 6 Check all student counters to see if point was registered.

A) If okay see step 7
B) If not registered:
   1) Give another point to double check
   2) If it does not work - report in maintenance log

Step 7 Clear Points from student desks.

Step 8 Check call lights at each student desk.

A) If okay - go to step 9.
B) If not working, report in maintenance log

Step 9 Turn on tape deck - play a tape for self to see if working.

A) If working go to step 10.
B) If not working -
   1) Check to see if deck is plugged in
   2) Check to see if tape is in correctly
   3) Check earphone plugs connection
   4) Is switch in down position?
   5) If still not working report problem in maintenance log

Step 10 Rewind tape, if necessary

Step 11 Turn off tape deck.

Step 12 Turn on intercom.

A) To check if functioning talk to each student. If okay go to step 12.
B) If problem:
   1) Is switch in up position?
   2) Are you depressing talk switch?
   3) Turn up volume.
   4) Are plugs in securely?
   5) Is intercom plugged in?
   6) If still down - report problem in maintenance log.

Step 13 Turn off intercom.

Step 14 TEACH

<u>After Teaching</u>

Step 15 Place all intercom switches in middle position.

Step 16 Turn off intercom.

Step 17 Rewind tape.

Step 18 Turn off tape deck.

Step 19 Turn off individual OHP's

Step 20 Turn off master OHP switch.

Step 21 Return all point switches to off position.

Step 22 Return point counters to zero (teacher's console).

Step 23 <u>FILL OUT MAINTENANCE LOG.</u>

Step 24 Clear points from student desks.

THE OHIO STATE UNIVERSITY

COLLEGE OF EDUCATION

# Faculty for Exceptional Children

*Hereby acknowledges that*

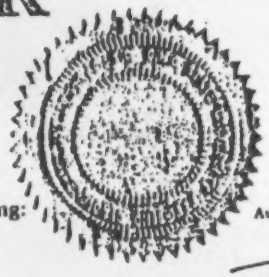
## Georgina J. Hingman

*Has successfully mastered the competencies needed to become a*

# VISUAL RESPONSE SYSTEM TEACHER

— By Demonstrating the Following Skills —

- Operation of VRS Equipment
- Software Production
- Preparation of VRS Lesson Plans
- Instructional Management Principles, Including:
  - —Reinforcement techniques
  - —Token economy systems
  - —Remediation techniques
  - —Generalization techniques
  - —How to handle disruptive behavior



Awarded on: September 7, 1962
Date

Thomas M. Stephens, Chairman
Faculty for Exceptional Children

[illegible] Instruction Coordinator

William L. Heward, Director
Visual Response System Project

(c)

PRE-POST TEST

TEACHING IN THE VISUAL RESPONSE SYSTEM

1. Name three (3) ways of combining presentation modes in the VRS. (3)

   1. _____

   2. _____

   3. _____

2. Name six (6) ways of presenting materials on the overhead projector for maximum effectiveness. (6)

   1. _____ 4. _____

   2. _____ 5. _____

   3. _____ 6. _____

3. Name eight (8) ways in which a student may respond in the VRS. (8)

   1. _____ 5. _____

   2. _____ 6. _____

   3. _____ 7. _____

   4. _____ 8. _____

4. Define reinforcement. (1) _____

   _____

   _____

5. Fill in the blank. (2)

   _____ Continuous reinforcement

   _____ Intermittent reinforcement

   1) Increase behavior

   2) Maintain behavior

6. Name four (4) types of reinforcers that can be used in the VRS. (4)

   1. _____ 3. _____

   2. _____ 4. _____

7. Name three (3) ways to determine possible reinforcers for use in the VRS. (3)

1. _____

2. _____

3. _____

8. Define a token. (1) _____

_____

_____

9. a. What is used as tokens in the VRS? (1)

_____

b. How are points delivered to each student's feedback unit? (1)

_____

10. What three (3) things must you remember when setting up a store for the token system in the VRS? (3)

1. _____

_____

2. _____

_____

3. _____

_____

11. Dave, a very shy student, has just made a mistake in his work that you feel requires remediation, how would you deal with this situation in the VRS? (1)

_____

_____

_____

_____

_____

12. When might you use the teacher's overhead projector for remediation? (1)

_____

_____

_____

_____

13. You should always try to remediate student errors without _____ and/or _____. (2)

14. Describe three (3) techniques that you (the VRS teacher) can do in the VRS to promote generalization to the regular classroom. (3)

1. _____

_____

2. _____

_____

3. _____

_____

15. Name three (3) things that you can do in the regular classroom to promote generalization from the VRS to the regular classroom. (3)

1. _____

_____

2. _____

_____

3. _____

_____

16. One method used to promote generalization is to switch from intermittent reinforcement to continuous reinforcement. (1)

a. true
b. false

17. Describe three (3) techniques that can be used in the VRS to handle disruptive behavior. (3)

1. _____

_____

2. _____

_____

3. _____

_____

18. A carefully planned introductory session in the VRS can help deter future disruptive behavior. (1)

a. true
b. false

19. When choosing materials, both commercial and self-made, what two (2) criteria must be kept in mind? (2)

1. _____

2. _____

20. What are four (4) variables that you should consider when making your own transparencies? (4)

1. _____

2. _____

3. _____

4. _____

21. List five (5) reasons for mounting your transparencies? (5)

1. _____

2. _____

3. _____

4. _____

5. _____

22. Write a sample lesson plan for the VRS. (12)

SAMPLE LECTURE TRANSPARENCIES

#19T

# REMEDIATE

## WITHOUT

① PUNISHMENT

② EMBARASSMENT

# PRESENTING MATERIALS WITH THE OVERHEAD PROJECTOR

① Use of On-Off Switch

② Masking

③ Progressive Disclosure

④ Pointing Out

⑤ Overlays

⑥ Moving Parts

⑦ Projection of Real Objects

⑧ Write On Transparencies ✓

Daily Evaluations - Paper-Pencil

Objective #4

1. Name 3 ways of combining presentation modes in the VRS.

Objective #5

1. Name 6 ways of presenting materials on the overhead projector for maximum effectiveness.

Objective #6

1. Which student response material would you use for...
   a. writing a sentence?
   b. spelling?
   c. solving a math problem?
   d. fill-in the blanks?
   e. copy a paragraph?

Objective #7

1. Define reinforcement
2. Match

| | |
|---|---|
| __continuous reinforcement | a. increase a new behavior |
| __intermittent reinforcement | b. maintain a behavior |

Objective #8

1. Define token
2. a) what will you use as tokens in the VRS?
   b) how will they be given to the student?
   c) what three things must you remember when setting up a store for a token economy system in the VRS?

Objective #9

1. Dave is a very shy student who has just made a mistake in his work, how would you deal with the situation?
2. When would you use the teacher's overhead projector for remediation? Give an example.
3. You should always try to remediate with _a_ and _b_.

Objective #10

1. Name two things you can do in the VRS to promote generalization from the VRS to the regular classroom?
2. Name three things you can do in the regular class to promote generalization from the VRS to the regular classroom.
3. T or F A method used to promote generalization is to switch from an intermittent schedule of reinforcement to a continuous schedule of reinforcement.

Objective #11

1. Name and define three techniques that can be used to handle disruptive behavior in the VRS.
2. T or F A carefully planned introductory session in the VRS can deter disruptive behavior in the future.

Objective #13

1. What are three variables that you should consider when making your own transparencies?
2. What are four reasons for mounting your transparencies?

TRAINEE QUESTIONNAIRE
(Group I)

NAME: _____

SUBJECT: _____

COLLEGE DEGREE(S): _____ CERTIFICATION _____

YEARS OF TEACHING EXPERIENCE: _____

Visual Response System
In-Service
Questionnaire

Date _____

1. I felt the strong points of the VRS in-service were: _____

_____

_____

2. I felt the weak points of the VRS in-service were: _____

_____

_____

3. I felt the quizzes were: (check one)

unfair _____ generally fair _____ always fair _____

4. I felt the subject matter was presented: (check one)

too slow _____ just right _____ too fast _____

5. I feel I can operate all VRS hardware. (check one)

yes _____ no _____

If no, why not? _____

_____

6. I feel I can produce my own software. (check one)

yes _____ no _____

If no, why not? _____

_____

7. I feel I understand the following constructional techniques.
(check each you understand)

_____ reinforcement

_____ token economy systems

_____ remediation

_____ generalization

_____ disruptive behavior

281

Questionnaire (cont.)

I feel I can prepare lesson plans for the VRS.

yes _____ no _____

If no, why not? _____

_____

9. I feel that it takes longer to prepare a lesson for the VRS than for the regular classroom.

yes _____ no _____

10. I am looking forward to teaching in the VRS?

yes _____ no _____

If no, why not? _____

_____

11. Overall, I am glad I participated in the VRS in-service.

yes _____ no _____

If no, why not? _____

_____

Additional Comments/Suggestions: _____

_____

_____

_____

_____

VISUAL RESPONSE SYSTEM LESSON PLAN

Name Trainee I - Group I

Date

Subject Writing Checks

Objective. Students will write checks correctly.

Student Response. Students will write checks when given nine different problems.

Teaching Materials. "How To Write a Check" -- transparency. Transparencies with nine different problems. Blank check transparency. Water soluable pen.

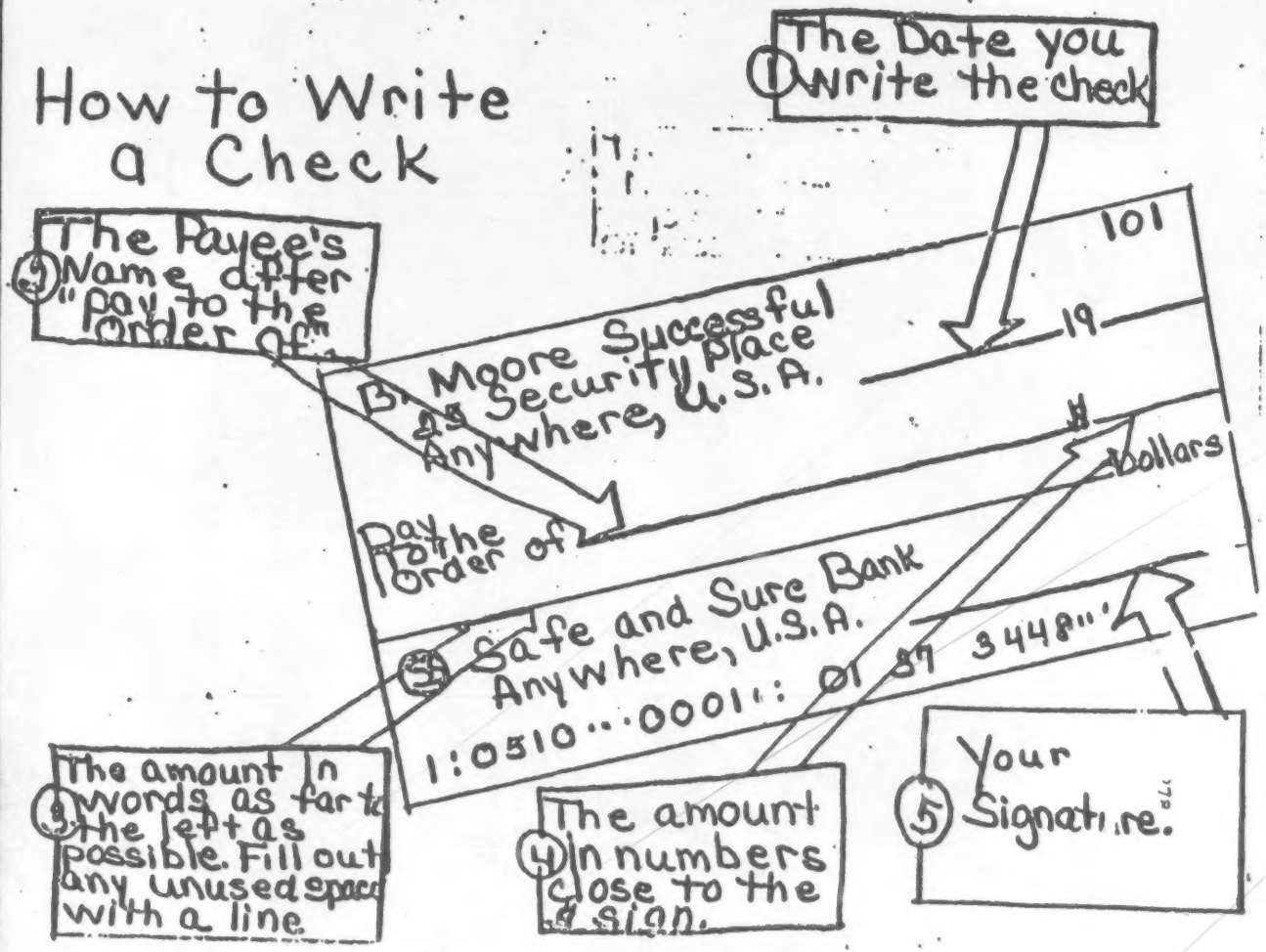
Student Materials. Check form transparency, water soluable pens, cleaning fluid, cloth.

Feedback. 5 points for each check completed correctly (1 point per line). Use intercom if any or one student needs help. (45 total points)

Evaluation. Record and graph student points, record and graph percentage of correct checks. (Number correct over number possible)

283

# How to Write a Check


1 The Date you Write the check
2 The Payee's Name after "pay to the order of"
3 Safe and Sure Bank Anywhere, U.S.A.
4 The amount in numbers close to the $ sign.
5 Your Signature.
101
19
Moore Successful Security Place Anywhere, U.S.A.
Pay to the Order of
Dollars
1:0510...0001:: 01 37 3448...
The amount in words as far to the left as possible. Fill out any unused space with a line.

1. On July 3 you have your car serviced and write check #101 to Carl's Auto Service for $19.88.

2. You pick up your dry-cleaning at Snowhite's Drycleaning on July 7 and write check #102 for $6.40.

3. Your mother's birthday (July 11) calls for some shopping and you write check #103 for $17.95 to Sue's Gift Shop.

4. Your monthly payment of $30 at Carson's Appliances is due on July 15 and you write check #101.

5. You pay rent to Towne Apartments on July 15 for $135.00. Check #102

6. On July 16 you purchased some new clothes at Martin's Department Store and wrote check #103 for $67.14.

7. On July 18 you visit your dentist and write Dr. J. L. Barker check #101 for $17.50.

8. You bought a pair of shoes for $6.15 at Hoffman's Shoes on July 29. Check #102.

9. The Lazarus bill came on July 30. You pay the bill which was $39.89. Check # 103.

47

Your name
2280 W. Broad
Columbus, Ohio

101
01-1
310

_____ 19____

Pay To The Order of _____ $_____

_____ Dollars

Safe and Sure Bank
Anywhere, U.S.A.

_____

1:0510···00011: 01 37 3448 11 '

58

Your name
2280 W. Broad
Columbus, Ohio

102
01-1
310

_____ 19____

Pay To The Order of _____ $_____

_____ Dollars

Safe and Sure Bank
Anywhere, U.S.A.

_____

1:0510···00011: 01 37 3448 11 '

69

Your name
2280 W. Broad
Columbus, Ohio

103
01-1
310

_____ 19____

Pay To The Order of _____ $_____

_____ Dollars

Safe and Sure Bank
Anywhere, U.S.A.

_____

1:0510···00011: 01 37 3448 11 '

VISUAL RESPONSE SYSTEM LESSON PLAN

Name Trainee 2, Group I

Date 6/78

Subject Science-Weather Map

Objective: Students will be able to reproduce basic weather symbols. Students will be able to interpret basic weather map.

Student Response: Drawing, writing

Teaching Materials: 1 ts cold-warm front, 1 quiz, correct answers, weather map, map with Qum, test, pointer, pen.

Student Materials: 1 alined ts, 1 map, pen, detergent, cloth

Feedback: 1 point for each quiz question, 2 points for each test question, 1 minute music for each point.

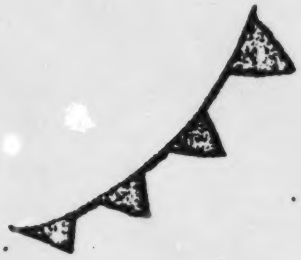
Evaluation:

| | # Wrong |
|---|---|
| A | 0-1 |
| B | 2 |
| C | 3 |
| D | 4 |

E

= Snow-flurries

= rain



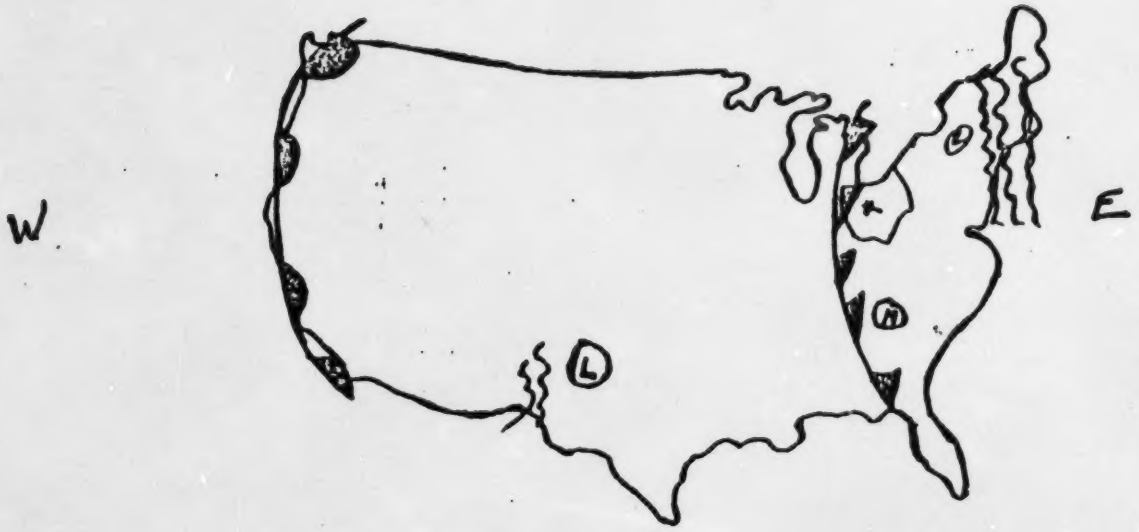
Cold front (looks like icicles)

warm front

# Quiz 1

1. Draw a cold front line

2. Draw a warm front line




= rain

= snow-flurries

1. Explain the ↗ line

2 Explain the ↘ line

3. Is the rain going to or away from Ohio?

242

# Quiz

1. A cold front approaching Ohio
2. A warm front over California
3. going away

243

# TEST

1. On Your Map Draw a warm front over the middle of Ohio and going further south

2 Using the {{ symbol show rain just having passed Columbus

3. Draw a cold front entering California

4 Using the {{{ symbol show rain just West of Columbus

5 Tell in two sentence what the weather has been in Columbus and what it will be

245

k

Trainee _____

Date _____

Grade P - F

/17 or /20

## FINAL EVALUATION

I. Hardware /7

| YES | NO |
|---|---|
| | |

1. Individual OHP'S
2. Teacher OHP
3. Lights
4. Points
5. Tape Deck/Music
6. Intercom
7. Turn off VRS

II. Instructional Techniques /4

| YES | NO |
|---|---|
| | |

1. Verbal Reinforcement
2. Points
3. Remediation
4. Disruptive behavior

III. Software /3 or /6

Pre-made

| YES | NO |
|---|---|
| | |

a) Visual
b) Active Student Response
c) Meets Interest.level

Locally Produced

| YES | NO |
|---|---|
| | |

a) Visual
b) Active Student Response
c) Meets Interest Level
d) Lettering
e) Simplicity
f) General Layout

IV. Lesson Plan /3

| YES | NO |
|---|---|
| | |

1. Student Materials
   a) Handed out before
   b) Easy to find answers

2. Teaching Materials
   a) Occasion Active Student Response
      L.T.E. _____

## Procedure II - Lesson Plans

### Session 1 - Introduction to the Visual Response System

Materials

1. Slide-tape show
2. Pre-test (See Appendix C)
3. Demonstrate Lesson Plan
4. In-service Schedule (See Appendix O)
5. Handbook "Teaching in the Visual Response System"
6. Description (Attendance Contingency" for trainee (Group III only) (See Appendix I

Procedure

1. Hand out materials (#4, 5, 6) to trainees and discuss each one.
   A. In-service schedule - discuss how each session will be conducted and that there will be a trainee evaluation, either practical or a "paper-pencil" in each session
   B. "Teaching in the Visual Response System" - give reading assignments as they correspond to weekly schedule.
2. Give the Pretest
3. Play the slide-tape show.
4. Run the demonstration lesson plan until the period ends.

3. Student response transparency

4. Non-permanent markers for all trainees.

Procedure

1. Instructor will demonstrate procedure trainees are to follow in their practical evaluation.
   A. Place math problem transparency on teacher's overhead projector.
   B. Turn on all student (trainee) overhead projectors. Students will respond by answering problems in corresponding boxes on student response transparency.
   C. Give points for all correct answers.
   D. Give a red light for all incorrect answers and point out which answer was incorrect.
   E. Shut down system.
2. Have each trainee run through evaluation (3 minutes/trainee) and evaluate using Teacher Console Trainee Evaluation Sheet.

Session 3 - Sound System (Objectives 1, 2, 3)

Materials

1. Instructional Checklist (See Appendix L)
2. Practical evaluation (See Appendix E)

Procedures

1. Instructor will demonstrate steps 9-13 of instructional checklist
2. Instructor will allow each trainee two minutes of practice with the sound system.

3. Trainees will perform practical evaluation.

Evaluation

1. Practical evaluation

Materials

1. Transparency with any type of visual stimuli.
2. Seven lined response transparencies
3. 7 non-permanent markers

Procedures

1. Instructor will demonstrate the practical evaluation as follows:
   A. Pass out response transparencies to all trainees.
   B. Place visual stimuli on teacher's overhead projector.
   C. Turn on all overhead projectors. Trainees will write sentences pertaining to the visual stimuli.
   D. As trainees are writing, play music to all students.
   E. As trainees are writing, use the intercom to give either reinforcement or remediation to each trainee.
   F. As trainees work, give them points for correct sentences.
   G. Shut down VRS.
2. Each trainee will be required to perform the above steps (three minutes/trainee).
3. Instructor will fill out evaluation sheet on each trainee.

Session IV - Projectors (Objectives 1, 2, 3, 4, 5)

Materials

1. Filmstrip projector and filmstrip
2. Slide projector
3. Slides of eight ways to use overhead projector
4. Evaluations
   a. Practical evaluation over use of projectors.
   b. Written assessment of Objective #4.
   c. Written assessment of Objective #5

Procedure

1. Demonstrate to trainees how to load and run each projector, using the remote control attachment.
2. Allow trainees to practice using each projector.
3. When each trainee is ready to be assessed, instructor will evaluate using Practical evaluation sheet for Projectors.
4. Using the slide carousel to show the eight ways of using the overhead projector effectively, demonstrate each method on teacher's overhead projector. (See Procedure section of lesson plan for Objective #4, Procedure I).
5. Administer evaluation to trainees.
6. Lecture on methods of combining presentation modes.
7. Administer evaluation to trainees.

Evaluation

1. Practical evaluation for projectors.
   a. Use evaluation form and give one point for each step demonstrated correctly.
2. Give written assessments for Objective #4 and 5. Provide feedback for each assessment.

Session V - Software ( (Objectives 6, 12)

Materials

1. Packet of student response transparencies
2. Response Slides
3. Project LIFE symbols
4. Lecture transparency 12T, 26T, 27T
5. Written evaluation of Objective #6
6. Commerical materials evaluation forms
7. Examples of commercial materials
   a. Language Arts transparencies
   b. Homonyms transparencies
   c. Adventures in Imagination filmstrips and cassettes
   d. Objectives for Descriptive Writing.

Procedure

1. Show each type of student response transparency available.
2. Show lecture transparency 12T and disclose each one at a time using progressive disclosure. Give examples of which response transparencies could be used for each response. (See Appendix M)
3. Give written assessment on student response materials.

4. Hand out VRS commerical materials evaluation form. Discuss each section. 26T, 27T
5. Show commercial materials and discuss in relation to commerical materials evaluation form.

Evaluation

1. Give written assessment for Objective #6 and provide feedback on results.

Session 6 - Software II (Objective 13)

Materials

1. Lecture transparencies 28T, 28T(a)
2. Written evaluation #8E
3. Thermafax
4. Masters for thermafax
5. Write-on transparencies
6. Thermafax film
7. Frames, large and small

Procedure

1. Show lecture transparency 28T and discuss the criteria of a good transparency.
2. Show lecture transparency 28T and discuss the reasons for mounting transparency.
3. Give written evaluation to trainees.
4. Demonstrate the use of the thermafax.
5. Demonstrate how to frame transparencies.

6. Demonstrate how to make Response Slides
   a. Show how to make using thermafax by making the transparency and then framing.
   b. Show how to make using write-on transparency and writing on transparency after it has been framed.
7. Give trainees assignment to make the following:
   a. Transparency from self-made master.
   b. Transparency from commercially produced master.
   c. Response Slide using either method.

Evaluation

1. Give written assessment for objective #13 and provide necessary feedback upon completion of assessment.
2. Trainees are required to hand-in all locally produced transparencies.

Session 7 - Lesson Plans (Objective 14, excluding final evaluation)

Materials

1. Lesson plan for check writing (See Appendix I)
2. Lesson plan outline (See Appendix N)
3. Sign-up sheet
4. Lecture transparency #36T

Procedure

1. Demonstrate the lesson plan on check writing.
2. Distribute lesson plan outlines to all trainees.
3. Using lecture transparency 36T as an example, discuss the six parts of a lesson plan.
4. Have trainees sign up for time slots to practice their lesson during one of the next three sessions.
5. Make sure each trainee has an idea of what they are going to do for their lesson plan before session ends.

Evaluation

1. Evaluation of written lesson plan in regards to each of the six parts.

Session 8 - Reinforcement and Token Economy System (Objective 7, 8)

Materials

1. Lesson on jobs developed by Trainee #4, Group I
2. Lecture transparencies #13T, 14T, 15T, 16T, 17T, 39T, 40T
3. Written evaluations #3E, 4E
4. Lesson plan evaluation forms.

Procedures

1. Demonstrate Trainee #1, Group I lesson plans on jobs. This is to demonstrate a lesson as well as the types of reinforcers that are available in the VRS, use, lights, points, music, visual and verbal reinforcers, as lesson is demonstrated.

2. Use lecture transparencies and discuss reinforcement and token economy systems.
   a. Transparency 13T- define reinforcement and give examples.
   b. Transparency 15T- describe the various types of reinforcers used in the VRS.
   c. Transparency 16T- define and give examples of the different schedules of reinforcement (intermitten and continuous)
   d. Transparency 14T- discuss four ways to determine reinforcer.
   e. Transparency 3E - written evaluation of reinforcement.
   f. Define token and give examples, i.e. money, points.
   g. Transparency 17T- discuss 3 factors in setting up a store for a token economy used in the VRS.
   h. Transparency 4E - written evaluation of token economy systems.
3. Three trainees will practice lesson plan developed for session 7. Trainees will present to class with other trainees acting as students. Practice sessions will run five to seven minutes for each trainee. Instructor will give verbal feedback to trainee as necessary. Instruction will also use final

evaluation form to evaluate trainee at this point. This will allow trainee to see where their strengths and weaknesses lie and to make the necessary modifications before the final lesson plan.

Evaluation

1. See numbers 2E and 2H above. Provide necessary feedback to trainees.
2. Final lesson plan evaluation form. Give the completed form to trainees as they finish their lesson. Also provide verbal reinforcement over those areas you wish other trainees to imitate.

Session 9 - Remediation (Objective 9)

Materials

1. Trainee 4, Group I job unit 39T, 40T
2. Lecture transparencies #19T, 20T(a)
3. Written evaluations 5E
4. Final lesson plan evaluation forms (Appendix K)

Procedure

1. Demonstrate remediation techniques using Trainee 4, Group I job unit. Demonstrate individual remediation techniques by using the intercom to provide individual attention to each trainee as they work. Also demonstrate group remediation techniques by one of three methods:

a. Collect all work and correct on teacher's overhead.

b. Show answers and have each trainee correct their own work.

c. Use the teacher overhead projector to show single correct answers to problems that a group or all trainees are having problems with.

2. Present lecture transparencies and discuss each one in regards to the VRS.

a. Transparency 19T Tell trainees remediation should occur without punishing (decreasing the student's behavior) and embarrassing the student.

b. Transparency 20Ta- Discuss the various methods of remediation available to the teacher in the VRS. Give rationale for using individual remediation techniques (least punishing and embarrassing) and for group remediation as a learning exercise of individuals will not be embarrassed or when all students are having a problem.

c. Transparency 5E - give written evaluation.

3. Three trainees will practice lesson plans and receive instruction and feedback when necessary.

Evaluation

1. Give written evaluation as designated above in number 2C and provide the necessary feedback to trainees.
2. Provide verbal remediation and reinforcement as well as written evaluation of trainee lesson plans after their practice session.

Session 10 - Disruptive Behavior and Generalization (Objectives 10, 11)

Materials

1. Lecture transparencies 22T, 23T, 24T, 25T, 6E, 7E
2. Final lesson plan evaluation forms.(See Appendix K)

Procedures

1. Present lecture transparencies and discuss each with trainees.
   a. Transparency 24T- Discuss how to prevent disruptive behavior from occurring in VRS by discussing the VRS in the regular classroom and by having a student orientation session in the VRS.
   b. Transparency 25T- Discuss the techniques to be used if disruptive behavior should occur in the VRS (extinction, time-out, and response cost).
   c. Transparency 7E - give written evaluation on disruptive behavior.

d. Transparency 22T give the definitions of generalization and give examples of generalization: 1) writing verbs in sentences in VRS to writing them in the regular classroom; 2) naming the place value of a number in the VRS to naming it in the regular classroom.

e. Transparency 23T- Discuss methods used to provide generalization from the VRS to the regular classroom. For lecture material see Generalization section in "Teaching in the VRS"

f. Transparency 6E - give written assessment on generalization.

2. The remaining trainees will practice their lesson plan.

Evaluation

1. Written evaluations given as designated by numbers 1C and 1F. Instructor will provide feedback as needed.

2. Instructor will provide trainee with written evaluation of lesson plan to allow trainee to make any needed adjustments before the final evaluation.

Sessions XI & XII - Final Evaluations (Objective 14)

Materials

1. Final Lesson Plan evaluation forms. (Appendix K)
2. Posttests (Appendix C)
3. Visual Response System In-service Questionnaires (See Appendix F)
4. Diplomas (Appendix B)

Procedure

1. Each trainee will be given a nine minute period in which to demonstrate their lesson plan. Instructor will evaluate each trainee useing final lesson plan evaluation form, all trainees will be required to achieve 90% to graduate.
2. Each trainee will be given a posttest to complete. A time limit of 25 minutes will be strictly followed,
3. Trainees will fill out the Visual Response System In-service Questionnaire.
4. The instructor will award Diplomas to trainees who met all in-service requirements

PRACTICAL EVALUATION--PROCEDURE I

Objectives 1, 2, 3

1. Demonstrate Steps 1-13 on Daily Checklist
2. Turn on desks 1, 2, 3, 4, and operate them as a block.
3. Give 2 points to desks 1, 3, 5, 7 and the red light to desks 2, 4, 6, 8.
4. Talk to me on intercom.
5. Give me music.
6. Give desk #2 music and talk to me.
7. Give me music and talk to desk #2.
8. Turn on teacher's overhead.
9. Down situations
   a. no power to OHP?
   b. Power but no light?
   c. Tape deck won't go on.
   d. Intecom isn't working.
10. Perform steps 15-24 on instructional checklist.
11. Load filmstrip projector, show 3 frames,
    without audio
    with audio
12. Load slide projector and show 3 slides.

PRACTICAL EVALUATION--PROCEDURE I

Objective 1 - Teacher's Console/Practicum

1. Math lesson - 2 digit multiplication
   students copy problems in corresponding boxes and solve
2. Trainee (3 min)
   - start lesson - turn on all OHP's
   - give points for correct answer
   - red light for wrong answer
     point to missed problem
   - shut down system

Materials

1. Math transparency with problems (2)
2. Answer sheet (1)
3. Response transparencies (7)
4. Markers (7)

APPENDIX I

PRACTICAL EVALUATION - PROCEDURE II

Objective 1 - Teacher's Console

Name_____

Date_____

| | YES | NO |
|---|---|---|
| 1. Start lesson-turn on all OHP's | | |
| 2. Give points for correct answers | | |
| 3. Red light for wrong | | |
| 4. Shut down system | | |

Grade____

Comments:

PRACTICAL EVALUATION--PROCEDURE II

Objective 1 - Sound System

1. Sentence writing

   - students will write as many sentences about stimuli as possible

2. Trainee Evaluation

   - turn on OHP's
   - give all students music
   - talk to each student and give points
   - shut down system

Materials

- visual stimuli (4)
- lined response transparencies (7)
  (finish one and erase)
- markers (7)

Objective 1 - Sound System

Name_____

Date_____

| | YES | NO |
|---|---|---|
| 1. Start - Turn on OHP's | | |
| 2. Give all students music | | |
| 3. Talk to each student | | |
| 4. Give points all same time | | |
| 5. Return student to music | | |
| 6. Shut down system | | |

Grade____

Comments:

PRACTICAL EVALUATION--PROCEDURE II

Objective --Projectors

1) Have trainers load and show 3 frames of filmstrip.

2) Load and show one slide

Objective 1 - Projectors

Name_____

Date_____

| | YES | NO |
|---|---|---|
| 1. Load Filmstrip Projector | | |
| 2. Show filmstrip | | |
| 3. Load Slide Projector | | |
| 4. Show slide | | |

Grade_____

Comments:

# APPENDIX XII

## Dissemination of Project Activities

# Feedback Good As Students Tune In On VRS Class

By Maureen Brown
*Of The Dispatch Staff*

The sounds of the rock group Led Zepplin fade. The lesson begins.

"What is LCM?" the students are asked through their headphones.

Howard, recalling the previous math lesson, correctly writes, "lowest common multiple." His answer is visible on the overhead projector behind his desk.

**A SERIES OF** math problems follow during the 50-minute lesson, with more gratifying moments of the strains of Led Zepplin interspersed between questions.

Obviously, the setting is not a traditional classroom but the director of the unusual class project would like to see public schools adopt a similar program.

The Visual Response System (VRS) at the Buckeye Youth Center is the only one in the country designed for mildly handicapped students and the only one in use at a juvenile correctional facility.

**THE VRS PROJECT**, which utilizes headphones and overhead projectors for a small group of students and a teacher, previously has been used only to teach deaf students.

"We're really excited about this. We think we've got something," said William Heward, project director and an assistant professor at Ohio State University.

Students in the project receive intensive instruction in reading, writing, spelling or math for one class period a day. Usually, eight students are in each class and desks are arranged in a horseshoe, allowing the teacher to view each student's answers projected on the screens behind them.

**THROUGH THE** headphone intercom system, the teacher may communicate with one or all of the students during the lesson.

The educational and research project boasts several advantages: feedback can be delivered immediately to the student; students can be corrected Heward said. "Outside of educational problems, these kids all have behavioral problems . . . they've robbed a store or beat someone up."

**THROUGH DAILY** and long-term evaluations, he said the VRS system gives instructors a clear picture of students' weaknesses and progress, and lessons can be planned accordingly.

The unusual classroom also allows instructors to experiment with teaching methods. In one class, for example, the student with the highest score gets to pick the music that will be played the following day. Two groups, Lynard Skynard and Boston, are the current favorites.

"It's turned out to be a big reinforcement," said Ann Marshall, one of four OSU graduate students working in the program.

**SHE ALSO SAID** she turns off the taped music if students get rowdy during a quiz or lesson.

Since the VRS classroom opened May 1, it has been used "very successfully" to teach students how to fill out job application forms, Heward said.

He said it's too early to measure the overall success of the program, but detailed reports and evaluations will be compiled at the end of the project in September.

**THE ONE-YEAR** project is funded through $70,000 in grants to OSU. It is being coordinated by the Faculty for Exceptional Children in the College of Education.

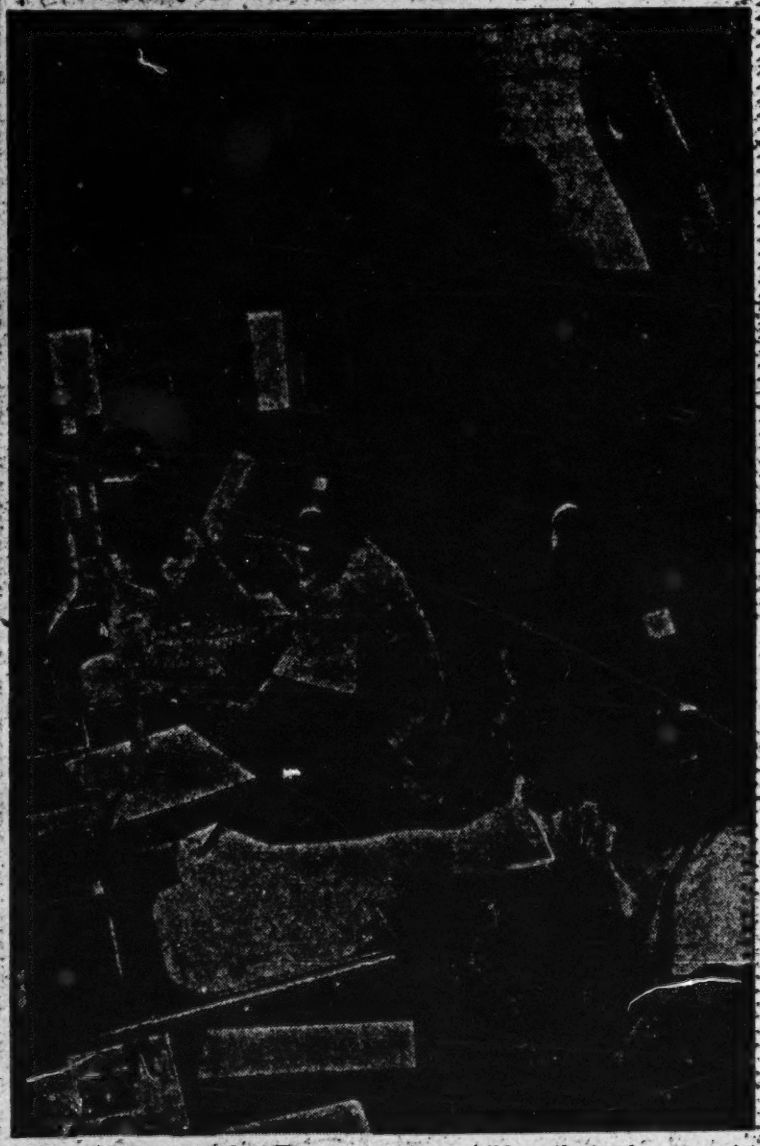
The grants were awarded by the Bureau of Education for the Handicapped in the U.S. Department of Health, Education and Welfare, and the Ohio Youth Commission (OYC), which operates Buckeye Youth Center at 2280 W. Broad St.

**HEWARD SAID** planning for the program and construction of the special classroom began in October and actual class work began in May. After it concludes in September, he plans to publish results in professional journals to encourage other schools to begin a

without being punished or embarrassed; all students respond actively and their responses can be observed directly; students enjoy the VRS and therefore may become more motivated to learn.

"Almost all the kids in this school have a terrible history in schools," VRS program.

"I'm absolutely convinced it's a very instructional technology," he said. There's no question that it helps teach deaf students, Heward said, and the same system can be used to teach educable mentally retarded children and those with learning disabilities.



MODERN TEACHING — These two students at Buckeye Youth Center write down answers to the math questions they are hearing on their headphones. The responses are projected onto a screen behind them, visible to the teacher, as part of an unusual teaching project called the Visual Response System. (Dispatch Photo by Glenn Cumberledge)

An in-service teacher training program is operating so that all BYC faculty who choose to do so can acquire the skills necessary to teach effectively in the VRS.

Further information and evaluative data on the VRS will be made available to school systems, educational programs, and other interested agencies or individuals upon request. For further information write:


Ronald Stewart, Principal
H. H. Goddard High School
Buckeye Youth Center
2280 W. Broad Street
Columbus, OH 43223

-or-

William L. Heward, VRS Project Director
Faculty for Exceptional Children
College of Education
The Ohio State University
356 Arps Hall
1945 N. High Street
Columbus, OH 43210


*The teacher demonstrates how she can reward students by playing contemporary music through student headphones.*

# VISUAL RESPONSE SYSTEM PROJECT

# OHIO YOUTH COMMISSION


**Ohio Youth Commission**

James A. Rhodes
*Governor*

William K. Willis
*Director*

M. B. McLane
*Deputy Director*
*Correctional Services*

Joseph R. Palmer, Ph.D.
*Deputy Director*
*Community Services*

**The Ohio State University College of Education**

Frederick R. Cyphert, Ed.D.
*Dean*

Thomas M. Stephens, Ed.D.
*Chairman*
*Faculty for Exceptional Children*

William L. Heward, Ed.D.
*VRS Project Director*
*Faculty for Exceptional Children*



The Ohio Youth Commission is proud to announce a unique and promising educational research and development project. The Visual Response System (VRS) project is being conducted at Buckeye Youth Center, an OYC-operated high school and residential treatment facility for juvenile offenders located in Columbus, Ohio. The VRS project is a joint venture with the Faculty for Exceptional Children, College of Education, The Ohio State University. Funding is provided by the OYC and by a grant made to the Ohio State University Research Foundation from the Bureau of Education for the Handicapped, U.S. Department of Health, Education, and Welfare.


## What Is A Visual Response System?

In 1967, Dr. Raymond Wyman at the University of Massachusetts created the Mediated Interaction Visual Response System (later shortened to Visual Response System) to raise the level of teacher-student interaction in classrooms for the deaf. The VRS is an instructional environment for a small group of students (usually 8 to 10) where all the students simultaneously respond on overhead projectors to a series of teacher presentations.

Each student's desk has an attached or built-in overhead projector. The teacher also has an overhead projector, and possibly a filmstrip or slide projector and a tape recorder, with which to present stimuli for student response. An intercom system with student headphones lets the teacher give students individual instructions or feedback. A control console at the teacher's desk operates the overhead projectors, the sound system, and electric counters and feedback lights at each student's desk.

There is no one way in which a VRS must be designed, but it is common to arrange the student desks in a horseshoe with the teacher's desk at the open end. Projectors may be focused on screens or the classroom wall behind them. With the horseshoe shape, the teacher can easily scan and evaluate all of the student's projected responses from the open end.

## Some of the positive instructional features of the VRS are:

1. **Students respond actively.** There is no taking turns in the VRS. Each student can respond to every question, problem, or situation.

2. **All student responses can be observed directly.** With the student overhead projectors "on", the teacher has instant and continuous visual access to all student responses.

3. **Many types of responses can be made in the VRS.** So far over 30 different responses that can be made on an overhead projector have been identified. Just a few of these are writing, pointing, circling, matching, solving math problems, and drawing.

4. **The VRS provides for multisensory learning.** In one sense, Visual Response System is a misnomer. Students can receive stimuli visually (projected images), auditorily (headphones), tactually (by manipulating objects on the overhead projector), or in any combination of those three sensory modes. Likewise, students can respond motorically and/or orally. We might just as well call the VRS a multi-modality learning laboratory.

5. **Feedback can be delivered immediately.** In one study of writing conducted in a VRS at the Boston School for the Deaf, the average feedback delay (measured from the moment a student placed a period at the end of a correct sentence until a teacher delivered point was registered on a counter at the student's desk) was four seconds. The speed of this feedback compares favorably with a situation where students perform academic tasks one day and receive feedback in the form of a graded paper the next day. Of course, the amount of reinforcement delay varies with the responses students make, but in the VRS it can always be measured in seconds as opposed to minutes, hours, or days.

6. **Many types of rewards can be used.** In addition to social praise and recognition, a teacher can use projected visual images, flashing green lights, electrically delivered points, and music to reward students for improved performance.

7. **Students can be remediated without being punished or embarrassed.** Verbal remediation can be given to individual students privately via the intercom system. The teacher may place correct answers on his/her overhead, or point out the correct responses of peers as models and reward students for correcting their own errors.

8. **Full interaction is facilitated in a group of students.** Since students can see all of the responses their peers make, unless the teacher does not wish them to and keeps their overheads "off" while they are responding, student-student interaction can become an integral part of the instructional process.

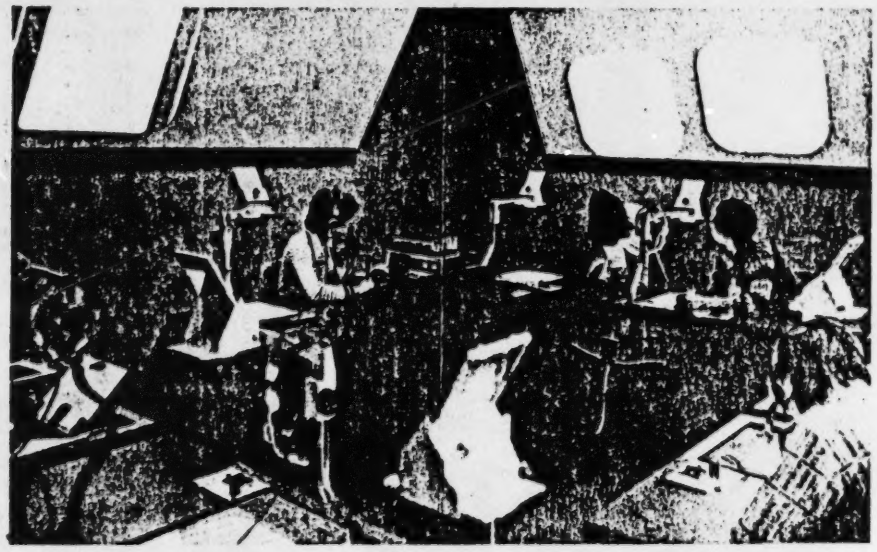
9. **Instruction can be individualized.** There are several ways instruction can be individualized in the VRS: (1) students can go through a sequence of projected questions or problems at their own pace; (2) response requirements can be individualized, for instance, some students may be required to write the word "red," while others may only have to match the color by placing a piece of red acetate on their projectors; and (3) by dividing a stimulus transparency into parts, different students can respond to material varying in content and/or level of difficulty.

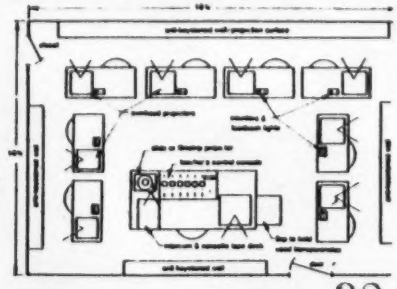
10. **Evaluation of student progress can be a direct by-product of a lesson.** If counters are used to reward correct responses and the teacher keeps track of the total response opportunities in a given session, he or she simply needs to review the point total for each student in order to measure the student's success.

11. **Students enjoy the VRS.** This may be the greatest of all the VRS features. Today's students are surrounded by technological hardware everyday and the VRS allows them to be users of technology rather than mere observers. Many teachers report that students with a history of indifference have become motivated learners in the VRS.

## Project Activities

There are presently about 10 VRS's in operation at residential schools for the deaf across the country. The VRS has been very successful with deaf students, and there's no indication it won't be just as successful with hearing students. The VRS at Buckeye Youth Center (BYC) is the first installation to be designed and evaluated as a resource room for mildly handicapped (learning disabled and educably mentally retarded) students. Groups of eight students are scheduled in the VRS for one class period each day. While the VRS lends itself to the teaching of many subjects, students at BYC with poor school records and deficient academic skills are coming to the room for intensive drill primarily in the tool subjects--reading, writing, spelling, and arithmetic. Instructional materials and activities are being developed in each of these areas as well as for several special VRS programs. For example, one VRS program is currently being developed to teach students how to fill out employment applications.



*Buckeye Youth Center students review a classmate's response.*

VISUAL RESPONSE SYSTEM - BUCKEYE YOUTH CENTER